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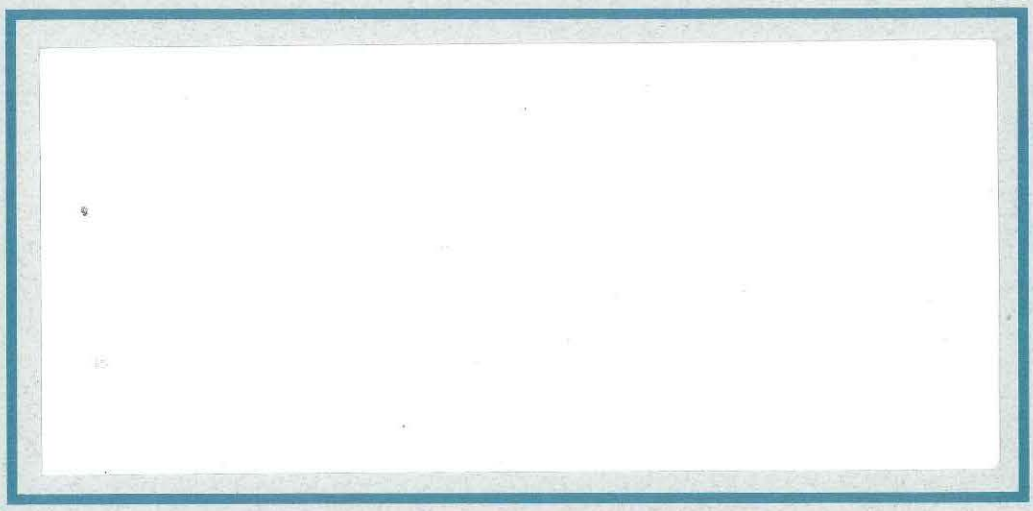

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AIR SPARGING/SOIL VAPOR EXTRACTION DESIGN SUMMARY TECHALLOY COMPANY, INC.

Prepared for

TECHALLOY COMPANY, INC.
Union, Illinois

Prepared by

ROY F. WESTON, INC.
Three Hawthorn Parkway
Vernon Hills, Illinois 60061

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SECTION 1
INTRODUCTION

An air sparge/ soil vapor extraction (AS/SVE) system to provide source reduction in the source area of the plume was proposed in addition to the previously installed groundwater extraction and treatment system as part of the recommended remedial corrective measure for this site, which was identified as alternative GW-2A in the CMS report. This alternative recommended that an air sparge/SVE pilot test be implemented in order to increase the reliability of the proposed full-scale treatment system. The AS/SVE system design for the Techalloy Company site uses the results from the pilot tests along with data from the RI/FS and the CMS as a design basis.

The air sparge portion of the system is designed to reduce VOC concentrations in the targeted source area of the groundwater plume by volatilization. The targeted source area of the plume was identified as the approximate area of the on-site plume having total estimated VOC concentrations above 30,000 ug/l, which is shown in Figure 1, "AS/SVE System Treatment Areas and Influence". This targeted area is based upon groundwater samples containing concentrations of the Contaminants of Concern (COC's) in excess of the target clean-up levels. Risk-based on-site groundwater target clean-up levels were calculated and reported in Table 2-13 of the CMS report, which is included in Appendix A.

The SVE system is designed to serve two functions, reduction of VOC concentrations in the targeted unsaturated soil source area via volatilization and removal of volatilized VOC vapors produced by the air sparge system. The targeted unsaturated soil source area containing VOC's was identified as the approximate area in the vicinity of the Concrete Evaporation Pad having total VOC concentrations above 40,000 ug/Kg, which is delineated in Figure 1. This targeted area is based upon soil samples containing concentrations of the COC's in excess of the target clean-up levels. Risk-based on-site soil target clean-up levels were calculated and reported in Table 2-11 of the CMS report, which is also included in Appendix A.

Soil stabilization of areas impacted by heavy metals will be implemented in the year following completion of the AS/SVE system. In order to implement the AS/SVE design limited soil

stabilization will be conducted as described in detail in Section 5 of this report. Areas impacted by heavy metals and the areas of limited soil stabilization are depicted in Figure 2.

SECTION 2
PILOT TEST RESULTS SUMMARY

2.1 SVE TEST RESULTS

Pilot test results indicate that the horizontal and vertical permeabilities of the subsurface soils are approximately 37 darcies and 1.5 darcies, respectively, using data from the vertical vent resulting in a K_h/K_v, ratio of 24.7. Horizontal vent test results indicate a K_h of 147 darcies and a K_v of 2.0 darcies with a K_h/K_v, ratio of 73.5. The intrinsic air permeability estimate based upon the data from the vertical SVE test is a better estimate because the data fits the model assumptions better than the data from the horizontal SVE test. These values indicate high intrinsic permeability and highly preferential flow in the horizontal direction.

It is likely that vertical flow through the vadose zone is severely reduced, as indicated by the high K_h/K_v ratio for two possible reasons. The first is the less permeable topsoil and fill overlaying the site and the second is a concretized layer of fill 3 to 4 feet below ground surface (bgs) that extends across the site, both of which act like a cap. The concretized layer of fill is similar to that encountered underneath the former spent acid pond located along the northern border of the site. Based on the following rationale; the open nature of the site with few obstructions, the shallow water table, the high permeability of the sand layer above the water table and the cap-like effect illustrated by the results of the SVE modeling, this site is ideal for horizontally configured SVE vents.

1,1,1-Trichloroethane (TCA), trichloroethene (TCE), and tetrachloroethene (PCE) and the major contaminants in the soil and groundwater at this site, all have a vapor specific gravity greater than air and a specific gravity greater than water. Therefore, under equilibrium conditions, vapor phase TCA, for instance, present above the water table, tends to "sink" to the lower portion of the unsaturated zone. Due to its relative volatility, TCA can be readily stripped from groundwater utilizing air-sparging technology. However, due to the potential for volatilized TCA to remain near the potentiometric surface, vapor extraction points will be screened to intersect the water table in order to maximize removal of compounds via air sparging.

2.2 AIR SPARGE TEST RESULTS

Based on pilot test results the effective air-sparging radius of influence was estimated conservatively at 30 feet with a 50 scfm injection flow rate. The pilot test results indicated that at this flow rate, TCA was effectively removed from groundwater. The lower test flow rate of 25 scfm resulted in a smaller radius of influence, and the higher flow rate of 75 scfm showed no significant increase in influence and indicated some channeling may have occurred. Therefore, a nominal 50-scfm flow rate was recommended. Since the pilot test also indicated somewhat heterogeneous airflow through the saturated zone, the recommended separation distance of air sparge points is nominally 50 feet. This will allow some overlap (approximately 5 feet) and compensate for potential unequal influence radially from the sparge points. Due to the apparent anisotropic conditions present in the aquifer medium, the effective air sparge radius of influence was calculated conservatively at 30 feet to ensure adequate influence over the area of concern. However, as described in the pilot test report some parameters indicated influence out as far as 50 feet.

SECTION 3
SOIL VAPOR EXTRACTION SYSTEM DESIGN

3.1 HORIZONTAL VENT DESIGN

Based on results of pilot testing, soil vapor extraction wells will be constructed using a horizontal configuration with a screened interval of 40 feet exposed to the unsaturated zone. The 40 foot screens will be installed in a trench using pea gravel as a filter pack. In order to maximize flow at the potentiometric surface and allow for fluctuations in water table elevation, the pea gravel in the trench will extend from the water table surface to 2.5 feet above the aquifer. The pea gravel will not extend below the water table. The SVE vent design specifies that a 6 inch diameter, 0.20-slot PVC screen to be placed 2.5 feet (30 inches) above the water table elevation. At the time of the pilot test the water table elevation was recorded at 826 feet msl. This will place the invert elevation of the screen nominally 5.5 feet below ground surface. A 6 inch layer of pea gravel will then be installed over the top of the screen, followed by three layers of 8-mil polyethylene plastic sheeting. A 6-12 inch sand layer will be placed over the plastic sheeting prior to installation of general fill to grade.

Three layers of 8-mil polyethylene plastic sheeting are specified as a vapor barrier to prevent short circuiting rather than a landfill liner type material for several reasons. This material is readily available, is much easier to handle and install, is appropriate to the design life of the treatment system and will meet the requirements of the design. This design has been field proven and will provide an adequate vapor barrier and prevent siltation of the pea gravel by the overlying sand backfill. Having 3 layers of polyethylene combine to make a 24-mil barrier, which can be more durable than a single 20-mil sheet of polyethylene. The two outer sheets protect the middle sheet against direct contact and abrasion, making it less susceptible to tearing.

The design extraction flow rate per horizontal extraction vent is 200 to 250 scfm at 18 to 20 inches of water column gauge (IWCG), respectively, for a 40-foot screen. According to the pilot test analysis it is estimated that a flow rate of 100 scfm will provide for a soil gas venting rate of one pore volume per day at a distance of 79 feet from the center of a 20 foot screen in the extraction trench. This means that a molecule of air that enters the soil/air interface 79 feet from

the vent trench will take approximately one day to travel through the vadose zone to the vent screen. Those areas closer to the vent than 79 feet will have a higher pore volume exchange rate and those areas further away will have a lower exchange rate. A 40 foot screened trench at an extraction rate of 250 scfm at 20 IWCG will provide a slightly greater radius of influence than 79 feet (as measured by pore volume exchange), compared to a 20 foot screened trench. A 40-foot screen will also provide a higher flow rate, better vapor capture, and was used as a basis for design of the full scale system. Given the same flow and vacuum the analysis estimates a radius of influence of 100 feet at a two-day pore volume exchange rate.

Designing the horizontal SVE vent with 30 inches of freeboard above the water table (rather than the 18-inches of freeboard used for the pilot test vent) gives ample clearance to allow for the maximum possible 20-inch capillary rise of groundwater. This leaves 10-inches of freeboard to accommodate a rise in regional water table elevation to the invert elevation of the vent. Also, the horizontal vents will function as designed, even when half full of water, which gives an additional 3-inches of clearance. This total of 33 inches of freeboard will prevent surging (under normal operating conditions) which was noted in the Pilot Scale AS/SVE Study. Additionally, controls will be installed to shut down the AS/SVE system if water table rises to the top of the horizontal vent screens, as described in the following section on Air Sparging Design.

The full-scale SVE system was designed with seven 45-foot trenches along a line roughly bisecting the identified on-site soil and groundwater VOC plume. Each 45-foot trench will contain a 40-foot section of screen, gravel pack and vapor barrier along with a bentonite end seal. System design flow rate is 1750 cfm, continuously, at approximately 36 IWCG of vacuum, including estimated piping and minor frictional losses. The SVE trenches were located to avoid the areas identified with heavy metals in the soils and minimize the amount of stabilization required during this phase of the remediation. The stabilization design for this phase of the remediation and all other phases is discussed later in this report. The trenches will be installed in one continuous excavation operation. A continuous installation will require proper seal design and installation between the trench sections in order to avoid short circuiting. A five foot bentonite slurry mixed with pea gravel will be installed between each vent.

A nominal five foot long seal comprised of a bentonite slurry mixed with pea gravel or sand will be installed between each 40 foot vent. After pea gravel has been placed over each end of the horizontal vent screen, the polyethylene vapor barrier for each vent will be extended down to the bottom of the trench. This will prevent the bentonite slurry from entering the gravel pack. The seal will then be installed between the horizontal vents, extending 3.5 feet above the water table to the top of the gravel pack.

SVE zones of influence for the entire system are shown on Figure 1. The one pore volume per day influence area encompasses the following areas: the soil clean-up target area with total VOC concentrations in excess of 40 mg/Kg, the target groundwater plume area with total VOC concentrations in excess of 30 mg/l and the design influence area of the air sparge system. The two pore volume per day influence area encompasses both VOC target areas and the maximum (50 foot ROI) potential influence area of the air sparge system. Thus, the SVE system influence exceeds the extent of both soil and groundwater target clean-up areas, and therefore, has the capacity to support the remediation goals.

3.2 SVE EQUIPMENT AND CONTROLS

The equipment for the SVE system will consist of a flow control manifold, a water separator and a pressure blower. The flow control manifold assembly is made up of individual 4-inch diameter vacuum vent lines or risers that enter the treatment building through the concrete floor and connect to the 10-inch diameter header pipe that conveys the vapors to the water separator. Each riser will be fitted with a flow control valve, an averaging pilot tube flow meter, a vacuum gauge and sample port. The header will be fitted with a vacuum gauge. The water separator is connected between the blower and the header to remove any water that may become entrained in the vapor stream. A transfer pump will automatically drain the water separator to a 500-gallon storage tank. The blower will discharge the vapor stream through a silencer and stack to the atmosphere.

Manifold control, instrumentation and monitoring components and their functions are listed below:

- Flow control valve- function is to throttle airflow rate from the vent and to reduce vacuum in vent. It is used to balance the system in terms of flow and vapor concentration, if required. Also, used to isolate vent from system if no longer needed or repairs were needed on vent or piping.

- Pitot tube flow meter- function of the averaging pitot tube is to measure vapor flow via pressure differential which is converted by a direct reading gauge into a flow rate in scfm units. Range of gauge will be 0-350 scfm.

- Vacuum gauge- function is to measure vacuum in vent line in units of IWCG. Range of gauge will be 0-30 IWCG.

- Sample port- function is to allow field measurement of VOC concentrations in each vent line with PID/FID while system is in operation.

The stack will be fitted with a pilot tube type air flow meter that is equipped with an electronic sensor to transmit both instantaneous and total flow to the programmable logic controller (PLC). A stationary stack gas sampling system will periodically sample the SVE discharge. The sampling system will be equipped with a solid state sensor that is specific to chlorinated compounds. The proportional sampling system will have both a localized visual readout (in ppm) and will transmit a signal to the PLC, which will automatically monitor and log the gas concentration data. Details of the flow measurement and sampling system are included in Section 13442 of the Specifications.

3.3 SVE PERMITTING AND MONITORING

Based on calculated mass removal rates during the combined AS/SVE pilot test and estimates of VOC mass residuals in the soil and groundwater [previously submitted to EPA and estimated at 1,800 Kg (3.96 tons) in soil and 915 Kg (2.01 tons) in groundwater], air emissions will be able to meet current IEPA air discharge permit requirements. A permit to construct and a permit to operate the SVE system will be required by IEPA as a modification to the facilities existing air emissions permit. Techalloy is considered a minor source because it discharges less than 10 tons per year of hazardous air pollutants (HAPS) and less than 25 tons per year of volatile organic materials (VOMs) at a rate less than 8 lb/hr. Currently the facility emits approximately 2 tons/year of HAPs. Assuming, as a worst case analysis, the unlikely event that 100% of the VOC residuals were removed by the AS/SVE system in one year the total HAPs emissions

would be about 8 tons, well under the 10 ton limit. The facility would still be considered a minor source. As a minor source no air pollution control equipment is required by the IEPA.

Field testing and sampling for laboratory analysis and calibration of the automated stack sampling system will be conducted during system start-up. All wellhead sampling and data acquisition will be performed inside the equipment building at the manifold sample port for each vacuum line, allowing year round operation, since many field instruments cannot operate below 32° F. Parameters will include vacuum/pressure, temperature, flow rate, and VOC concentration. Field sampling of VOCs will be carried out with a combined PID/FID portable unit, a Foxboro TVA-1000, which has a range of 0-50,000 ppm. Air samples will be acquired using EPA methods 2 and 18 for lab analysis of VOC's and will be correlated with FID field readings and the automated stack sampling system.

Lab samples for VOC's and field data will be collected from the discharge of the SVE system. Discharge stack laboratory sample frequency of monitoring will be one per week for one month of operation; monthly thereafter or as indicated by IEPA air discharge permit requirements. Samples will be by drawing 10 liters of vapor from the stack at 100 ml/minute through activated charcoal tubes. Samples will be laboratory analyzed for the following parameters:

- TCA
- PCE
- TCE
- 1,1-DCE
- 1,1-DCA
- Ethyl benzene
- Xylene

The following parameters of SVE system performance will be monitored and recorded whenever a stack sample is acquired:

- Total SVE system flow rate measured by stack pitot tube flow meter in SCFM.
- Total VOC concentration in stack as measured by stack gas sampling system in PPM.
- Vacuum in blower intake manifold in IWCG.
- Individual vent flow rates measured by vent line pitot tube flow meter in SCFM.

- Individual vent vacuums measured by gauge on vent line in IWCG.
- VOC concentrations in each vent line at sampling port as measured by field PID/FID in PPM.

Performance criteria for the SVE system are the following:

- 1750 cfm vapor flow rate at 36 IWCG as measured at the intake of the SVE blower.
- 200 to 250 cfm vapor flow rate per horizontal vent as measured at the manifold.
- 0.05 IWCG vacuum or greater at 79 feet from center of horizontal vent system.

Performance and acceptance criteria for individual components of the SVE system are included in each section of the Specifications.

SECTION 4
AIR SPARGING SYSTEM DESIGN

4.1 SPARGE WELL DESIGN

The AS system is designed to reduce VOC concentrations in the targeted source area of the groundwater plume via volatilization by in-situ air stripping. All of the COC's have high Henries coefficients and are easily removed from groundwater by sparging. Based on the results of pilot testing, sparge well construction design will consist of a 2-inch diameter, 3-foot long, 0.10-inch stainless steel screen connected to a 2-inch diameter black steel riser. The sparge well points will be placed below the water table at the depth above the silty clay will adequately allow for effecting injection of air into the saturated zone. The depth of the screened portion of the sparge point should be at the desired depth of cleanup. The screen depth and the desired depth for cleanup are, therefore, the depth necessary to reach the remediation goals. In the case of this site, of the entire aquifer is impacted down to the depth of the clay/sand interface.

This depth could range from 32 to 88 feet bgs, (according to boring log data from the RI/FS) depending upon the location of the clay layer at the bottom of the sand aquifer. Subsequent to the pilot test, two borings that were advanced to 65 feet on the north side of the site (down gradient), along the southern edge of the former acid pond, did not locate the clay interface at the bottom of the sand aquifer. Consequently, the depth to the clay confining layer could range from 65 to 88 feet or more in the area to be treated and injection pressures may vary from 10.5 to approximately 36 psi, including piping losses, but not including manifold losses. This unknown factor required design of the compressed air delivery system to be flexible enough to cover the maximum possible injection pressure range that could be expected across the site. The exact depth of the sparge points will be determined in the field at the time of installation.

The pilot test results indicated that to effectively recover compounds removed from the groundwater via air sparging, and control vapor migration, a vapor extraction to air sparge flow rate ratio of greater than 4 to 1 is needed. Given the flow rates recommended above, the ratio would be approximately 5 to 1 for a 40-foot horizontal vent at 250 scfm and a sparge point at 50 scfm.

4.2 LAYOUT AND AREA OF INFLUENCE

In order to provide effective sparging influence in the targeted groundwater plume (area greater than 30 mg/l total VOC's) treatment zone and volume of the aquifer, 16 new wells and one existing sparge pilot test well (a total of 17 sparge wells) will be utilized at depths that may vary from 32 to 88 feet bgs. The bottom of the sparge point will be placed at the sand/clay interface.

Sparge wells were spaced closer together at the down gradient end of the treatment zone, 40 to 50 feet apart, because of the greater volume of groundwater requiring treatment due to the increased depth of the aquifer in this area. In the source area most heavily impacted by VOC's, sparge wells were also spaced closer together, 40 feet or less, to provide a higher air to water ratio for more effective stripping of the VOCs.

AS system influence is shown on Figure 1 for both the effective design ROI of 30 feet and the maximum observed ROI of 50 feet. Although there are some minor areas outside of the 30-foot ROI in the central part of the targeted area of the plume, they are well within the 50-foot maximum ROI. Additionally, in all cases, these minor areas are up-gradient of the 30-foot ROI of the next down-gradient sparge point and the natural groundwater flow will transport the groundwater in these areas through that 30-foot ROI zone. Therefore, the AS system design provides adequate sparge point spacing, influence and depth to treat the extent of the targeted area exceeding 30 mg/l total VOC's in the groundwater.

4.3 EQUIPMENT, CONTROLS, OPERATION AND MONITORING

In order to supply air efficiently to the sparge wells, they were split into two groups, shallow and deep. The deep sparge wells were defined as the 9 wells (S-9D through S-17D) located where the combined static head at the clay/sand interface, entrance and line pressure losses were greater than 15 psi and the shallow wells (S-1S through S-9S) less than 15 psi. The air for each group is supplied by two separate systems comprised of an air compressor and flow control manifold. Each group of sparge wells is supplied by the type of compressor that can deliver air most efficiently for that particular pressure range on a continuous basis. The highest potential pressure required by the estimated maximum sparge well pressure head is slightly greater than 36 psi. The optimal type of compressor for this application is an oil-less, two-stage air rotary screw

compressor. For the grouping of shallow sparge points under 15 psi, an oil-less, positive displacement blower is optimal for the flow rate required. The manifolds for each system are the same.

The flow control manifold consists of the header pipe, the control valves, and the fittings and sensors on each of the individual air lines leading to the air sparge wells. Each air line is fitted with a check valve, electric solenoid valve, throttle valve, air flow meter and pressure gauge. The header pipe from each compressor will be equipped with a vortex shedding totalizing flow meter connected to the PLC, check valve, and pressure gauge.

Manifold control, instrumentation and monitoring components and their functions are listed below:

- Throttle valve- function is to reduce air flow and balance the flow rates to each sparge well and to isolate sparge well from system if needed.
- Air flow meter-a calibrated direct reading in-line device to measure air flow in SCFM.
- Pressure gauge- function is to measure pressure in line in PSI.
- Electric solenoid valve- function is to admit compressed air into sparge well and allow control of sparge cycle by PLC.
- Check valve- function is to prevent back pressure on solenoid valve when it is closed.

The following parameters of AS system performance will be monitored and recorded whenever a stack sample is acquired:

- Total deep AS system flow rate measured by air flow meter in SCFM.
- Total deep AS system pressure measured by manifold gauge in PSI.
- Total shallow AS system flow rate measured by air flow meter in SCFM.
- Total shallow AS system pressure measured by manifold gauge in PSI.
- Flow in each sparge line measured by air flow meter in SCFM.
- Pressure in each sparge line measured by gauge in PSI.

The AS/SVE system will be controlled by a PLC located within a separate instrument room inside the equipment building. The PLC will monitor and control all functions of the system. These include: vacuum blower, PD blower, rotary screw compressor, SVE system vapor flow rate, air sparge systems flow rates, air sparge manifold solenoid valves, transfer pump, motor cycles and run time, and all alarm conditions. Further detailed description of the functioning of the control system is included in the Specifications-Section 13441.

The PLC will be interconnected with an auto dialer to call and annunciate various alarm conditions. The SVE system will be interlocked with both sparge systems such that if the SVE system is not functioning within normal ranges the sparge systems will be shut down. Water level in the aquifer will be monitored via pressure transducers in three monitoring wells and all systems will be shut down if levels exceed horizontal SVE screen elevation. This provision is necessary because of observed seasonal flooding in the area and the shallow water table. Other alarm conditions include; motor high temperature, compressor high pressure and temperature, knock-out tank and storage tank high water, SVE low air flow, intercooler high temperature and sump high level. A table of AS/SVE system interlocks, alarm conditions, set points and actions can be found on page 13441-13 of the Specifications.

The nine deep air sparge wells will be divided into groups of three wells of similar depth. Compressed air will be delivered sequentially to each of the three groups. The PLC can be programmed to deliver 150 cfm of air to the first set of three wells for a period of four hours, then open the next set of three solenoid valves for an overlapping period of time. This will allow airflow to become established in the next set of sparge wells making a smooth transition of pressure and avoiding possible deadheading of the compressors, prior to shutting off air to the first group of wells. Each deep air sparge well will operate for a total of approximately 8 hours per day at 50 cfm. The same sequencing arrangement will be implemented for the eight shallow sparge wells, with 200 cfm being delivered to four wells at four hour intervals. The air delivery rate per day to the shallow wells is greater because this area has higher concentrations of the contaminants of concern (COCs). Each shallow air sparge well will operate for approximately 12 hours per day at 50 cfm. The SVE system will operate continuously at 1750 cfm and the air sparge system will be injecting 350 cfm of air resulting in a 5 to 1 extraction/injection ratio.

The four-hour cycle time is given as an example to illustrate the flexibility of a PLC based control system. Any cycle time or grouping of sparge wells can be configured by programming the PLC. Cycle times could be anywhere from a few minutes to several days. A short cycle time, however, in a conductive aquifer such as this may promote distribution of air through the pulsing effect. A sparge well for the most part does not create bubbles, it creates a spider web of micro channels initialy displacing the groundwater and causing it to move away from the sparge well and may initiate a small current in highly transmissive aquifers. Initiating and then collapsing these micro channels may well improve removal efficiency. P.C. Johnson in his 1997 paper "Effects of IAS Process Changes On The Removal of Immiscible-Phase Hydrocarbons" suggests that "pulsing air injection improves the long term cumulative removal efficiency". He noted an approximate 30% increase in mass removal relative to steady air injection at the same rate. It is highly likely that cycle time will vary considerably depending upon the site conditions. The performance of the sparge system cycle will be monitored and optimized for site conditions during the start-up period.

Sequencing the operation of the sparge systems has several advantages. It significantly reduces the size and horsepower of the compressed air systems and provides better distribution of air within the aquifer. The system has the flexibility to maintain the optimal dissolved oxygen concentration in the groundwater plume to promote volitilization and to deliver air at a rate that will provide optimal in-situ air stripping of the COCs.

The system has the flexibility to deliver air at a rate that will provide insitu-air stripping of the COCs.

Performance criteria for the AS system include the following:

- 150 scfm air flow delivery rate at 36 psi as measured at the discharge of the two-stage rotary screw compressor.
- 200 scfm air flow delivery rate at 15 psi as measured at the discharge of the positive displacement blower.
- 50 scfm air injection rate minimum for each sparge well at a minimum pressure equal to the static water head pressure measured from the top of screened interval to current static water table elevation.

Performance and acceptance criteria for individual components of the AS system are included in each section of the Specifications. Sparge wells and observation wells that do not meet performance criteria will have their casings pulled and inspected. The well will be redrilled in the same location with a larger diameter borehole. Steel casings and screens may be reinstalled if no defects are found or they are repairable. PVC casings may not be reused.

4.4 AS/SVE SYSTEM INSTALLATION

Installation of the AS/SVE system will be implemented by the Construction Manager (CM) for the Owner. The CM will be responsible for construction oversight of all subcontractors and will act as Engineer. The CM will also be responsible for all QA/QC functions. The limited soil stabilization, excavation, piping, structural, mechanical and electrical portions of the project will be contracted directly with the Owner. The drilling and installation of the sparge wells and observation wells will be subcontracted by the CM. The CM will be responsible for construction quality assurance as indicated in each section of the Specifications. Quality control is discussed in Section 01400 of the Specifications.

SECTION 5
SOIL STABILIZATION DESIGN SUMMARY

5.1 INTRODUCTION

Full-scale soil stabilization activities will take place the year following installation of the AS/SVE system. All Task 2 items will be formally documented and submitted for review at that time prior to initiation of construction. Approximately 10% of the total volume of soil to be stabilized will require removal and treatment in order to facilitate installation of the AS/SVE system.

This section summarizes the soil stabilization treatability study performed during September 1999 for the Techalloy Facility in Union, Illinois. The treatability study was conducted as part of the Consent Order activities to obtain information necessary for preparing the design documents for the soil stabilization. The objectives and the study organization are discussed below.

5.1.1 Objectives

WESTON prepared a Treatability Study Work Plan for the Techalloy site in September of 1999 and weekly progress reports were submitted to U.S. EPA during the study. Based on the Work Plan, Weston sampled about 15 gallons of Techalloy site soil and sent it to Kiber Environmental Services (Kiber) to perform the bench scale treatability study. The effectiveness of the stabilization process depends on the initial soil characteristics. The bench scale treatability study was necessary to determine the effectiveness of various reagents and their concentrations to successfully stabilize the soil. The objectives of the treatability study were as follows:

- 95% reduction of TCLP arsenic, chromium, nickel, and lead concentrations as compared to untreated levels;
- Unconfined compressive strength values of 20 pounds per square inch after 2 days and 50 lbs/in^2 after 28 days; and
- Permeability value of less than 1.0×10^{-6} centimeters per second (cm/sec) after 28 days of curing.

Kiber performed the treatability study in order to achieve this criteria. The following sections discuss the results of the treatability study.

5.2 SAMPLING PROCEDURES

5.2.1 Objectives

The objective of the sampling plan was to collect a representative 15-gallon composite sample of soil from the Techalloy facility. The composite sample was evaluated for phosphate/ Portland cement, Portland cement/fly ash, and Portland cement.

5.2.2 Sample Locations

Based on the remedial design samples, sampling locations for the composite sample were collected at locations C1, C2, C3, and C4, as designated in Figure 2.

5.2.3 Sampling Steps

- Using a decontaminated backhoe bucket, three inches of topsoil was removed from the sampling area before the sampling began. Each sampling location consisted of collecting soil at three depths. The first depth was just below the surface (0-3ft.), the second depth was between four and 6 feet. The third depth was between seven and 10 feet, or just above the water table. With the backhoe, approximately 4 gallons of soil was removed at each sampling location, C1, C2, C3, and C4 (1.33 gallons per depth). The soil samples were then placed in polyethylene bags inside 5-gallon, closed-head polyethylene containers using a stainless steel trowel when needed. Four 5-gallon containers were needed to contain the total volume of soil. The depth of removal for the sample did not exceed 10 feet below ground surface at any location.

- Once samples from locations C1, C2, C3, and C4 were collected, the soil samples were placed in a plastic container that could accommodate 20 gallons of soil. A decontaminated shovel was used to break up the material into pieces approximately 1/2 inch or less in diameter. The sample material was then mixed using the decontaminated shovel. This action was repeated at least three times. The homogenizing process was considered complete when the texture and color of the sample appeared uniform throughout.

- Upon completion of the homogenization process, the soil was placed back into the polyethylene bags inside the 5-gallon containers.

- The containers were labeled using marker with the composite sample ID location. The label was attached indicating date, sampler, time and anticipated contaminants.
- All sample information was recorded in the field logbook and the chain-of-custody forms were completed.
- The sampling equipment was decontaminated using Alconox and water.
- The labels were completed using waterproof ink prior to sample collection. Sample label and chain-of-custody forms had the following information:
  - Name of sampler.
  - Date and time of sample collection.
  - Sample number with location ID.

5.3 TREATABILITY STUDY PROCEDURES

There are many different techniques that have been established to stabilize soil. The three stabilization reagents evaluated in the Treatability Study (TS) were Type I Portland cement, fly ash, and phosphoric acid. This report will discuss the TS procedures used by Kiber, the results of the TS, and the most advantageous stabilization method for the hazardous soil at the Techalloy site. Information contained in this document was referenced from the *Treatability Study Final Report* submitted to WESTON by Kiber Environmental Services, Inc. which is included as Appendix B.

5.3.1 Sample Preparation

Prior to any TS testing, the untreated Techalloy site soil sample was composited and homogenized in the lab. The soil from all five drums was composited by placing the entire contents of each drum into a large blending chamber. After composition/homogenization, the composited soil was returned to the original sample drums for storage.

5.3.2 Characteristic Testing

After composition/homogenization activities, a representative aliquot of the untreated soil was collected for characterization testing. Characterization testing was performed to establish a

baseline for site soil quality prior to stabilization testing. The establishment of the baseline level of contamination is necessary to compare and determine the effectiveness of treatment, and to verify that the sample is representative of actual field conditions. The sample was submitted for the following analyses in accordance with the referenced test methods:

Total Volatiles	EPA Method 8260B
TCLP As, Cr, Ni, Pb	EPA Methods 1311/6010B
Hexavalent Chromium	EPA Method 3500D
Material pH	EPA Method 9045C

Geotechnical characterization analyses were also performed on the site soil sample. This data is useful for the preparation of cost estimates and design specifications with regard to full-scale treatment, material excavation, transport and storage. The following geotechnical characterization tests were conducted on aliquots of the untreated site soil in accordance with the referenced test methods:

Moisture Content	ASTM D 2216
Bulk Density	ASTM D 5057
Permeability	ASTM D 5084
Unconfined Compressive Strength	ASTM D 2166
Atterberg Limits	ASTM D 4318
Particle Size Analysis	ASTM D 422
Soil Classification	ASTM 2487
Proctor	ASTM D 698

Tables 1 and 2 (TS-Appendix B) contain the results of the characteristic testing of the site soil.

5.3.3 Stabilization Treatment

Stabilization involves a combination of physical and chemical processes, including macro encapsulation, microencapsulation, and pH control. These processes reduce contaminant leaching by decreasing the leach ability or solubility of contaminants of concern and by reducing the availability of the contaminants to a leachant (such as groundwater).

Stabilization is accomplished chiefly through the addition of Type I Portland cement or similar reagents. However, another common stabilization reagent is fly ash. This reagent is a type of pozzolans, which indicates that it is a non-cement reagent than can react with water to yield a cementitious reaction. Fly ash is often used in combination during full-scale stabilization to provide a reaction similar to cement treatment.

Cement- and pozzolanic-based stabilization treatment approaches can significantly increase the strength of site soils, especially at high reagent addition rates. However, at low reagent addition rates, cement is less likely to provide concrete-like strengths, and the material generally remains workable for handling, shipping and off-site disposal. In the same manner fly ash is not likely to provide as much strength as cement. The cement and hydrated lime/fly ash mixtures evaluated for this treatability study were designed with low reagent addition rates so that the treated material would remain relatively soil-like and workable.

Type I Portland cement is readily available throughout the country and are very consistent in quality. The fly ash used for testing was a Class "C" fly ash.

5.3.4 Chemical Fixation

Another common soil remediation approach is chemical fixation, in which the chemical form of a constituent is chemically converted to a less soluble form. For this project, a phosphate was chosen as the chemical fixation reagent. Thus, lead, being a contaminant of concern, was converted to lead phosphate with the addition of the phosphate chemical. Because the chemical fixation reagents lack cementitious or pozzolanic reagents, they do not hydrate with water to form a concrete-like material. Therefore, the treated materials remain soil-like, which aids in the ease of handling, transportation, and disposal.

For this TS, one phosphate -based reagent was evaluated, phosphoric acid.

5.3.5 Mixture Development

Six mixtures of the site soil and stabilization reagents were developed to evaluate stabilization treatment. These mixtures are presented in Table 3 (TS-Appendix B). Each mixture was developed by placing an aliquot of untreated soil into a blending chamber. All reagents were blended dry, slurried with water, and added to the untreated material chamber. For all the mixtures that required water in the stabilization process, potable tap water was used since distilled or deionized water is not practical for use in full-scale on-site remediation. All mixtures were blended at a rate of approximately 60 to 90 rotations per minute (rpm). All mixtures were developed in a similar manner with the exception of the mixture developed with 10% phosphoric acid solution. For this mixture, 10% phosphoric acid solution was added directly to the untreated aliquot and blended for a period of 1 minute or until homogenous. Once homogenous, Type I Portland cement was slurried with the specified amount of water and added to the mixture and blended.

For all mixtures, percent reagent and/or water additions were based on the initial weight of the untreated aliquot.

After mixture development, the treated materials were compacted into cylindrical sample molds for curing. The treated materials were allowed to cure for seven days in a humid environment maintained at a temperature between 18 and 24° C.

5.3.6 Confirmation Testing

Once the treated materials were allowed to cure for 2 days, the materials were submitted for unconfined compressive strength testing and were allowed to cure an additional 26 days. After a 28 day cure time, the treated materials were tested for the following parameters:

TCLP As, Cr, Ni, Pb	EPA Methods 1311/6010B
Unconfined Compressive Strength	ASTM D 2166
Permeability	ASTM D 5084

The results of the chemical and physical analyses performed on the treated materials after 28 days of curing are presented in tables 3 through 5 of the TS (Appendix B). Table 3 presents the results of unconfined compressive strength testing, while Table 4 includes the results of analytical evaluations. The results of permeability testing are included in Table 5.

5.4 TREATABILITY STUDY RESULTS

This section summarizes the results of the testing performed on the untreated soil material and of the treated soil materials.

5.4.1 Evaluation of Untreated Materials

During characteristic testing, the total volatiles analysis indicated that all but one compound were below detectable limits. The concentration of tetrachloroethene was slightly above the detection limit at 7 µg/L. The untreated soil had TCLP chromium, nickel, and lead concentrations of 0.13 milligrams per liter (mg/L), 2.26 mg/L and 14.3 mg/L, respectively. The TCLP arsenic concentration was below detectable limits. Hexavalent chromium in the untreated soil was also below detectable limits. The soil had an average material pH value of 6.3 standard units.

5.4.2 Evaluation of Treated Materials

The results of the unconfined compressive strength testing performed after 2 days of curing indicates that all reagent/soil mixtures, except the 10% Phosphoric Acid/Type I Portland Cement mixture, achieved the unconfined compressive strength value of 20 lbs/in^2. All reagent/soil mixtures that were tested for unconfined compressive strength after 28 days of curing exceeded the unconfined compressive strength value of 50 lbs/in^2. The higher the cement addition rate the higher the unconfined compressive strength.

Table 4 of the TS (Appendix A) presents the results of the TCLP arsenic, chromium, lead, and nickel analyses. The untreated TCLP concentrations of arsenic, chromium, and nickel were already relatively low, therefore, the 95% reduction values are extremely low. Specifically, all of these 95% criteria are below or near the federal drinking water maximum contaminant levels, with the exception of lead. Additionally, verification as to the exact concentration of either

arsenic or chromium down to the 95% criteria is very difficult and may be possible only under optimum conditions. Based on the results of the TCLP analyses performed on the untreated soil, the calculated performance criteria are as follows:

Metal	Untreated Concentration	95% Criteria	Federal Drinking Water MCL
Arsenic	<0.01 mg/L	<0.0005 mg/L	0.05 mg/L
Chromium	0.13 mg/L	0.0065 mg/L	0.1 mg/L
Lead	14.3 mg/L	0.715 mg/L	0.015 mg/L
Nickel	2.26 mg/L	0.113 mg/L	0.1 mg/L

Based on the previously listed criteria, none of the six treated materials were capable of achieving the TCLP arsenic or chromium criteria due to the extremely low 95% reduction values. With regard to arsenic, lowering of the detection limit below the reported value was not possible. The reported detection limit for arsenic represents the limits of the laboratory equipment. As for the chromium 95% reduction value, 0.0065 mg/L is approximately 15 times lower than the federal drinking water MCL, and may only be obtained under optimum conditions. The concentrations of the treated materials were approximately 3 times lower than the federal drinking water standard.

5.5 STABILIZATION METHOD SELECTION

Based upon an evaluation of the various soil mixtures the optimal method for stabilization was selected. For the soil at the Techalloy site, Type I Portland cement at 5% addition is the most advantageous method of stabilization. The Type I Portland cement at a 5% addition mixture had significantly reduced the TCLP arsenic, chromium, nickel, and lead concentrations. It also met all the performance criteria for unconfined compressive strength and permeability. Since the 5% Portland cement mixture has the least amount of reagent, it will also be the least [illegible] because less reagent will be required to stabilize the soil. The material stabilized with t[illegible] Portland cement remains workable with a low 5% addition. Portland cement is c[illegible] available and non-proprietary.

As for the phosphoric acid/ Portland cement mixture, it did not achieve the 20 lbs/in^2 u[illegible] compressive strength value after a 2 day cure time. The mixtures made up of Portlar[illegible]

and fly ash meet all performance criteria, however, they have combined percentages of 15% and 20%, thus being more costly.

An estimated total of 8,000 yd^3 of soil from the Techalloy site is to be excavated and stabilized. At a 5% addition, 400 yd^3 of Type I Portland cement and 400 yd^3 of tap water, are required to stabilize the soil.

5.6 SOIL STABILIZATION IMPLEMENTATION

For full-scale remediation at the Techalloy site, the site soil will be stabilized in-situ. The soil to be remediated will be marked off in 50 feet by feet sections. One composite sample will be taken from each delineated area to be tested for TCLP arsenic, chromium, lead, and nickel, prior to treatment. The 5% cement reagent and water will be added to the section and a backhoe or excavator will be used to excavate and mix the soil in place. Once the soil mixture is homogenous, the soil will be stockpiled and ten confirmation samples (five per 400 cubic yards of treated soil) will be collected from the walls of each excavation from a depth of 1-3 feet below ground surface. These confirmation samples will be analyzed for total arsenic, chromium, lead, and nickel. Also, every 400 cubic yards of treated soil will be tested for TCLP arsenic, chromium, lead, and nickel, unconfined compressive strength, and permeability. Once the sample results achieve the performance criteria and the walls of the excavation are below cleanup levels as designated in the Consent Order, the stabilized soil will be replaced in its original excavation.

Soil that is to be stabilized but is located in areas where the soil vapor extraction/air sparging (SVE/AS) system is to be installed will be stabilized as previously described. However, the stabilized soil will not be returned to its excavation due to its significantly reduced permeability, which would interfere with the SVE system effectiveness. Therefore, the treated soil will be stockpiled on other areas that are designated to be stabilized, as shown in Figure 2-3 of the Corrective Measures Study Addendum CAMU Designation Request. The stockpiled soil will remain in these areas until the rest of the soil designated for remediation is stabilized. All stockpiled soil will be covered with plastic and surrounded by silt fence in order to prevent sediment runoff to other areas of the site. The excavations will be backfilled with clean permeable, granular soil from an off-site borrow source and the AS/SVE system will be installed.

arsenic or chromium down to the 95% criteria is very difficult and may be possible only under optimum conditions. Based on the results of the TCLP analyses performed on the untreated soil, the calculated performance criteria are as follows:

Metal	Untreated Concentration	95% Criteria	Federal Drinking Water MCL
Arsenic	<0.01 mg/L	<0.0005 mg/L	0.05 mg/L
Chromium	0.13 mg/L	0.0065 mg/L	0.1 mg/L
Lead	14.3 mg/L	0.715 mg/L	0.015 mg/L
Nickel	2.26 mg/L	0.113 mg/L	0.1 mg/L

Based on the previously listed criteria, none of the six treated materials were capable of achieving the TCLP arsenic or chromium criteria due to the extremely low 95% reduction values. With regard to arsenic, lowering of the detection limit below the reported value was not possible. The reported detection limit for arsenic represents the limits of the laboratory equipment. As for the chromium 95% reduction value, 0.0065 mg/L is approximately 15 times lower than the federal drinking water MCL, and may only be obtained under optimum conditions. The concentrations of the treated materials were approximately 3 times lower than the federal drinking water standard.

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As for the phosphoric acid/ Portland cement mixture, it did not achieve the 20 lbs/in^2 unconfined compressive strength value after a 2 day cure time. The mixtures made up of Portland cement

and fly ash meet all performance criteria, however, they have combined percentages of 15% and 20%, thus being more costly.

An estimated total of 8,000 yd^3 of soil from the Techalloy site is to be excavated and stabilized. At a 5% addition, 400 yd^3 of Type I Portland cement and 400 yd^3 of tap water, are required to stabilize the soil.

5.6 SOIL STABILIZATION IMPLEMENTATION

For full-scale remediation at the Techalloy site, the site soil will be stabilized in-situ. The soil to be remediated will be marked off in 50 feet by feet sections. One composite sample will be taken from each delineated area to be tested for TCLP arsenic, chromium, lead, and nickel, prior to treatment. The 5% cement reagent and water will be added to the section and a backhoe or excavator will be used to excavate and mix the soil in place. Once the soil mixture is homogenous, the soil will be stockpiled and ten confirmation samples (five per 400 cubic yards of treated soil) will be collected from the walls of each excavation from a depth of 1-3 feet below ground surface. These confirmation samples will be analyzed for total arsenic, chromium, lead, and nickel. Also, every 400 cubic yards of treated soil will be tested for TCLP arsenic, chromium, lead, and nickel, unconfined compressive strength, and permeability. Once the sample results achieve the performance criteria and the walls of the excavation are below cleanup levels as designated in the Consent Order, the stabilized soil will be replaced in its original excavation.

Soil that is to be stabilized but is located in areas where the soil vapor extraction/air sparging (SVE/AS) system is to be installed will be stabilized as previously described. However, the stabilized soil will not be returned to its excavation due to its significantly reduced permeability, which would interfere with the SVE system effectiveness. Therefore, the treated soil will be stockpiled on other areas that are designated to be stabilized, as shown in Figure 2-3 of the Corrective Measures Study Addendum CAMU Designation Request. The stockpiled soil will remain in these areas until the rest of the soil designated for remediation is stabilized. All stockpiled soil will be covered with plastic and surrounded by silt fence in order to prevent sediment runoff to other areas of the site. The excavations will be backfilled with clean permeable, granular soil from an off-site borrow source and the AS/SVE system will be installed.

The stockpiled soil will be sampled and tested in the same manner as previously discussed, with the exception that confirmation samples will be taken as needed from side walls at the limits of the metals clean-up areas.

Areas less than 400 yards will be sampled proportionately to the volume removed for confirmation samples. A minimum of one sample per area will be collected before and after treatment.

5.6.1 Dust Exposure

Dust exposure is expected to be minimal during soil stabilization activities on site. The areas undergoing stabilization will be wetted down throughout the process. Monitoring will be conducted using personal particulate samplers (mini rams) which construction personnel will be required to wear to establish the TWA of both nuisance dust exposure and heavy metals exposure. Monitoring of personnel will be discontinued if it is documented that particulate levels are significantly below the action level after 2 days of continuous monitoring under working conditions. A downwind perimeter air sampling station for dust will be established to monitor for both nuisance and environmental dust. Exposure limits as dust particulates were calculated based upon average metals concentrations from samples taken in the areas closest to or within the areas of limited stabilization. An exposure limit of 1.56 mg/M3 was established as the action level for heavy metals as dust particulates for human health and safety. Calculations are included in Appendix C.

FIGURE

MAXIMUM AIR SPARGE INFLUENCE ZONE

STOCKPILE AREA DESIGNATED FOR CLEAN SPOIL MATERIAL FROM PIPING INSTALLATION

STOCKPILE AREA DESIGNATED FOR SPOIL MATERIAL ABOVE VOC OR METAL CLEANUP LEVEL

SVE CAPTURE ZONE (2-DAY PORE EXCHANGE RATE)

SVE CAPTURE ZONE (1-DAY PORE EXCHANGE RATE)

MINIMUM AIR SPARGE INFLUENCE ZONE (30-FOOT RADIUS)

BG-06

VOCs	SBS
1,1-DCE	140 J
1,1-DCA	300
1,2-DCE	160 J
1,1,1-TCA	2,200
TCE	52 J
PCE	73 J

MW-4

VOCs	GWS
TCA	120
TCE	38
PCE	130
1,1-DCA	52
1,2-DCE	18

MW-10

VOCs	GWS
TCA	51,000
TCE	960
PCE	940
1,1-DCE	4,500
1,1-DCA	1,710
1,2-DCE	810

MW-11

VOCs	GWS
TCA	83
PCE	47
1,1-DCE	21
1,1-PCA	45
1,2-DCE	150

CP-03

VOCs	GWS
1,1-DCE	22,000
1,1-DCA	3,300
1,2-PCE	1,000
1,2-DCA	63
1,1,1-TCA	200,000
TCE	12,000
PCE	3,600
BENZENE	17
VC	13
1,1,2-TCA	200

CP-03

VOCs	SBS
1,1,1-TCA	240,000J
PCE	66,000J
EB	55,000J
XY	200,000J

CP-07

VOCs	SBS
TCE	22,000J
1,1,1-TCA	140,000J
PCE	290,000J

WW-02

VOCs	SBS
PCE	43,000

CP-01

VOCs	SBS
PCE	280,000J

CP-05

VOCs	SBS
TCE	1,600,000J
PCE	370,000J

CP-11

VOCs	GWS
1,2-DCE	33
PCE	ND

CP-12

VOCs	GWS
1,1-DCA	13
1,2-DCE	10
1,1,1,-TCA	120
PCE	30

LEGEND

- INDICATES SVE CAPTURE ZONE
- INDICATES SPARGE INFLUENCE ZONE
- INDICATES APPROXIMATE AREA WHERE GROUNDWATER EXCEEDS 30mg/L TOTAL VOCs
- INDICATES APPROXIMATE AREA WHERE VOCS EXCEED 40 mg/kg SOIL TARGET CLEANUP LEVELS
- INDICATES APPROXIMATE AREA WHERE METALS EXCEED TARGET CLEANUP LEVELS
- S-1 SPARGE WELLS
- HV-1 HORIZONTAL VENTS
- AREAS TO BE EXCAVATED AND STOCKPILED FOR STABILIZATION

- EXISTING MONITORING WELL SAMPLING SEPT. 1994
- PHASE I SAMPLING LOCATION GEOPROBE AUGUST 1994
- PHASE II SAMPLING LOCATION SOILBORINGS MARCH/APRIL 1995

XY = XYLENE
EB = ETHYL BENZENE
MC = METHYLENE CHLORIDE
TCA = TRICHLOROETHANE
TCE = TRICHLOROETHENE
PCE = TETRACHLOROETHENE
ND = NON-DETECT
J = INDICATES ESTIMATED VALUE
VOC CONCENTRATION IN ug/kg (ppb)

SCALE 0 20'

NO.	DATE	APPR.	REVISION

TECHALLOY CO., INC.
REMEDIATION PHASE II
Union Illinois

WESTON MANAGERS DESIGNERS/CONSULTANTS
VERNON HILLS ILLINOIS

		DATE
CHECKED	–	
DES. ENG.	R.A.H.	2/00
PROJ. ENG.	R.A.S.	2/00
PROJ. MGR.	C.J.S.	2/00
APPROVED	–	
APPROVED	–	

CLIENT APPROVALS — DATE
ISSUED FOR — DATE

AS/SVE SYSTEM TREATMENT AREAS & INFLUENCE

DRAWN	DATE	DWG. NO.	REV. NO.
D.C.H.	MAY 2000	1	–
SCALE	W.O. NO.	SHT. 1 OF 1	
AS NOTED	019890310020100		

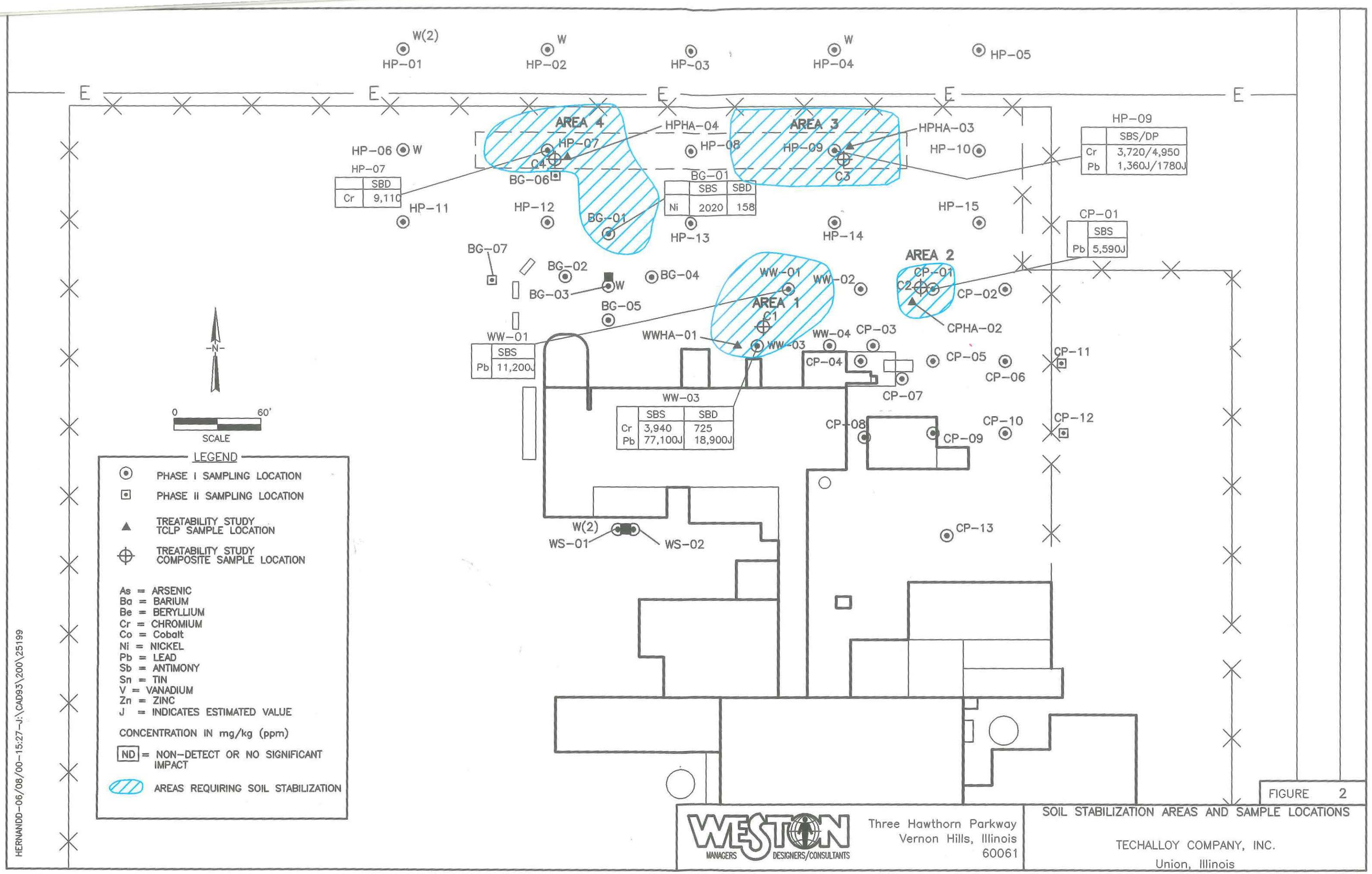

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FIGURE 2

SOIL STABILIZATION AREAS AND SAMPLE LOCATIONS

TECHALLOY COMPANY, INC.
Union, Illinois

WESTON MANAGERS DESIGNERS/CONSULTANTS
Three Hawthorn Parkway
Vernon Hills, Illinois
60061

APPENDIX A
TARGET CLEAN-UP LEVELS

Table 2-11
Soil Target Cleanup Levels
Techalloy Company, Inc.
Union, Illinois
(All concentrations in mg/kg)

Constituent	Target Cleanup Levels		Soil Target Cleanup Level
	Direct Contact Industrial	Migration to Groundwater	
Volatile Organic Compounds			
Carbon tetrachloride	--	0.071	0.071
1,2-Dichloroethane	--	0.129	0.129
1,2-Dichloroethene	--	0.531	0.531
Ethylbenzene	--	43.8	43.8
Methylene chloride	--	29.6	29.6
Tetrachloroethene	210 a	25.4	25.4
1,1,1-Trichloroethane	1,200 d	15.6	15.6
1,1,2-Trichloroethane	--	0.224	0.224
Trichloroethene	92 a	0.637	0.637
Xylenes	--	30	30
Inorganics			
Arsenic	240 b	--	240
Chromium (total)	42,000 b	1960 e	1960
Chromium (VI)	--	196	--
Chromium (III)	--	3.7×10^9	--
Lead	1,500 c	--	1500
Nickel	--	2665	2665

-- Soil screening level not exceeded for this exposure route.
a - Target cleanup level based on noncarcinogenic effects.
b - Target cleanup level is 100X screening level.
c - Target cleanup level based on *Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (U.S. EPA, December 1996e).
d - Target cleanup level is saturation concentration;
the U.S. EPA Region 9 PRG for this constituent is 6,300 mg/kg.
e - Based on 10% chromium VI.

Table 2-13
Groundwater Target Cleanup Levels
Techalloy Company, Inc.
Union, Illinois
All concentrations in µg/L

Constituent	Risk-based Concentration[a]	
	On-site	Off-site
Volatile Organic Compounds		
Benzene	16	5*
1,1-Dichloroethane	1,255	700
1,2-Dichloroethane	27	5*
1,1-Dichloroethene	12	7*
1,2-Dichloroethene	93	70 (cis)*
Methylene chloride	1218	5*
Tetrachloroethene	93	5*
1,1,1-Trichloroethane	1621	200*
1,1,2-Trichloroethane	37	5*
Trichloroethene	56	5*
Vinyl chloride	5.8	2*
Inorganics		
Chromium (total)	--	100*
Chromium (VI)	511	--
Chromium (III)	102200	--
Lead	--	15*
Nickel	2044	100*
Nitrate	163520	10000*

* Lower of U.S. EPA MCL or IEPA Class I groundwater quality standard (U.S. EPA, 1996d; IEPA, 1996).

[a] Based on Region 9 Preliminary Remediation Goals (U.S. EPA, 1996c).

APPENDIX B
TREATABILITY STUDY FINAL REPORT

KIBER
ENVIRONMENTAL
SERVICES

3145 Medlock Bridge Rd.
Norcross, Georgia 30071
tel 770-242-4090
fax 770-242-9198
www.kiber.com

26 January 2000

Mr. Richard Swearingen, P.E.
Roy F. Weston, Inc.
3 Hawthorn Parkway
Vernon Hills, Illinois 60061-1450
(847) 918-4000

Subject: Techalloy Treatability Study
Final Letter Report

Dear Mr. Swearingen:

Kiber Environmental Services, Inc. (Kiber) is pleased to present the results of the bench-scale stabilization / solidification treatability study conducted for Roy F. Weston, Inc. (Weston). The treatability study was performed on soil sampled from the Techalloy site located in Union, Illinois (the site). The performance criteria for the site as presented in Weston's cost proposal dated 21 September 1999 is as follows:

- 95% reduction of TCLP arsenic, chromium, nickel and lead concentrations as compared to untreated levels;
- unconfined compressive strength values of 20 pounds per square inch (lbs/in^2) after 2 days and 50 lbs/in^2 after 28 days; and
- permeability value of less than 1.0×10^{-6} centimeters per second (cm/sec) after 28 days of curing.

Kiber performed the Techalloy Treatability study in an effort to achieve these criteria. The following sections of this report included detailed information regarding the protocols followed during each phase of the study and the results of all testing performed.

TASK I: UNTREATED MATERIAL RECEIPT AND CHARACTERIZATION

On 28 September 1999 Kiber received five 5-gallon buckets of soil labeled UN 2291 from the site. The samples were delivered at ambient temperatures to Kiber's facilities in Norcross, Georgia via Federal Express delivery under proper chain of custody. A copy of the chain of custody is presented as Attachment A.

Upon receipt, Kiber placed the untreated buckets into refrigerated storage maintained at a temperature of 4 degrees Celsius (°C) in case the materials contained volatile organic compounds. Homogenization was conducted on the untreated soil after it had cooled to a temperature of 4°C to minimize the volatilization of organic materials that may be present. Homogenization was performed by placing all five buckets of the untreated sample into a stainless steel mixing vat and gently mixing with stainless steel utensils. For treatability testing, Kiber typically removes all particles or debris larger than 0.5 inches in diameter. All of the material received for testing was less than 0.5 inches in diameter. Once homogenized, the untreated material was placed back into the shipping containers and returned to refrigerated storage.

After homogenization, Kiber performed untreated characterization of the untreated material. Characterization of the untreated material is an essential component of the treatability study. The establishment of the baseline characteristics of the untreated soil is important for ensuring that the materials are similar to those expected at the site and for evaluating the effectiveness of the stabilization / solidification treatment. The following characterization analyses were conducted on aliquots of the untreated soil, after homogenization, in accordance with the referenced test methods:

Total Volatiles	EPA Method 8260B
TCLP As, Cr, Ni, Pb	EPA Methods 1311/6010B
Hexavalent Chromium	EPA Method 3500D
Material pH	EPA Method 9045C

Geotechnical characterization analyses were also performed by Kiber. This data is used to prepare cost estimates and design specifications with regard to full scale treatment, material excavation, transport and storage. The information generated is critical to making sound engineering decisions. The following geotechnical characterization tests were conducted on aliquots of the untreated soil in accordance with the referenced test method:

Moisture Content	ASTM D 2216
Bulk Density	ASTM D 5057
Permeability	ASTM D 5084
Unconfined Compressive Strength	ASTM D 2166
Atterberg Limits	ASTM D 4318
Particle Size Analysis	ASTM D 422
Soil Classification	ASTM D 2487
Proctor	ASTM D 698

Tables 1 and 2 present the results of untreated characterization of the site soil. Complete untreated characterization data reports are included in Attachment B. Review of the total volatiles data presented in Table 1 reveals that all but one compound were found below detectable limits. Specifically, tetrachloroethene was found slightly above the detection limit at a concentration of 7 ug/L.

Review of all remaining chemical and physical results, as presented in Table 2, indicate that the untreated soil had TCLP chromium, nickel and lead concentrations of 0.13 milligrams per liter (mg/L), 2.26 mg/L and 14.3 mg/L, respectively. The concentration for TCLP arsenic was found below detectable limits. Hexavalent chromium in the untreated soil was found below a detectable limit of 10 milligrams per kilogram (mg/kg). The soil exhibited an average material pH value of 6.3 standard units (s.u.).

The results of the physical analyses performed on the untreated soil indicate a dry-basis moisture content of 17%, a bulk density of 135 pounds per cubic foot (lbs/ft^3) and a bulk specific gravity of 2.2. The results of grain size analysis indicated that the soil was composed of 10% gravel, 76% sand, 8% silt and 6% clay. Atterberg limits verified that the untreated soil had no plastic or liquid limit and therefore no plasticity index. Based on the USCS soil classification the soil is identified as silty sand (SM) and based on the AASHTO classification A-2-4 (0.1). As requested by Weston, Kiber performed a proctor test which indicated a maximum dry density of 122 lbs/ft^3 at a dry-basis moisture content of 11.2%. In order to perform permeability and unconfined compressive strength testing on the untreated soil, Kiber remolded the site soil to 90% of optimum compaction. The results of permeability testing indicated a hydraulic conductivity of 3.9×10^{-4} cm/sec, while the results of unconfined compressive strength testing indicated a strength of 8 lbs/in^2.

TASK II: STABILIZATION TREATMENT

Upon completion of untreated material characterization testing, Kiber proceeded with stabilization treatment. Kiber outlined a total of six mixtures during this phase of the treatability study. Mixture designs were outlined by Kiber in an effort to achieve the site performance criteria while maintaining cost effectiveness. Reagents evaluated during this phase of the study include Type I Portland cement alone and in combination with Class "C" fly ash and 10% phosphoric acid solution. These treatment designs have proven successful in the past in treating similar materials.

Table 3 presents the mixtures performed by Kiber. This table includes Kiber's mixture numbers, the types of reagents used for each mixture, and the reagent addition rates for each mixture. Kiber developed all mixtures by placing aliquots of the untreated material into a blending chamber. All reagents were blended dry, slurried with water, and added to the untreated material and blended at a rate of 30 to 50 rotations per minute for a period of 60 to 90 seconds, or until homogenous. Note that all mixtures were developed in a similar manner with the exception of the mixture developed with 10% phosphoric acid solution. For this mixture, 10% phosphoric acid solution was added directly to the untreated aliquot and blended for a period of 1 minute or until homogenous. Once homogenous, Type I Portland cement was slurried with the specified amount of water and added to the mixture and blended.

A reported value for the percent reagent addition indicates that the reagent was added dry relative to the initial quantity of untreated material. For clarity, note that the "percent reagent" was based on the total weight of the material relative to the total weight of the untreated aliquot. For example, in a mixture with 10% reagent addition, 20 grams of reagent were added to 200 grams of untreated material and blended.

After treatment, the mixtures were compacted into cylindrical molds for curing. The treated materials were cured in a humid environment maintained at a temperature of 18 to 24°C. Upon completion of a 2-day cure, each treated material was subjected to unconfined compressive strength testing. The results of unconfined compressive strength testing are included in Table 3. A review of the results of 2-day unconfined compressive strength testing indicates that all treated materials with the exception of the material developed with a combination of cement and phosphoric acid solution achieved the performance criteria of 20 lbs/in^2 after 2 days of curing. Specifically, the treated materials developed with 5, 15 and 25% cement achieved strengths of 130, 611 and 1,049 lbs/in^2 after 2 days of curing. The mixtures developed with a combination of cement and fly ash achieved strengths of 240 and 420 lbs/in^2.

Following unconfined compressive strength testing performed after 2 days of curing, the treated materials were allowed to cure an additional 26 days. Upon reaching 28 days of curing, the treated materials were subjected to comprehensive analytical and geotechnical evaluations. Specifically, each of the six treated materials were subjected to the following characterization analyses in accordance with the referenced test methods:

TCLP As, Cr, Ni, Pb	EPA Methods 1311/6010B
Unconfined Compressive Strength	ASTM D 2166
Permeability	ASTM D 5084

The results of chemical and physical analyses performed on the treated materials after 28 days of curing are included in Tables 3 through 5. Table 3 presents the results of unconfined compressive strength testing, while Table 4 includes the results of analytical evaluations. The results of permeability testing are included in Table 5. Complete analytical and physical data reports are included in Attachment C.

The results of unconfined compressive strength testing performed after 28 days of curing, as presented in Table 3, indicates that all treated materials achieved the strength criteria of 50 lbs/in^2. Specifically, treated materials exhibited strength values ranging from 301 lbs/in^2 to 1,502 lbs/in^2. Note that higher cement addition rates resulted in higher unconfined compressive strength values.

Table 4 presents the results of TCLP arsenic, chromium, lead and nickel analyses. Note that as previously indicated the performance criteria for the treated materials included a 95% reduction of the TCLP concentrations present in the untreated soil. Based on the results of TCLP analyses performed on the untreated soil, the calculated performance criteria are as follows:

Metal	Untreated Concentration	95% Criteria	Federal Drinking Water MCL
Arsenic	<0.01 mg/L	<0.0005 mg/L	0.05 mg/L
Chromium	0.13 mg/L	0.0065 mg/L	0.1 mg/L
Lead	14.3 mg/L	0.715 mg/L	0.015 mg/L
Nickel	2.26 mg/L	0.113 mg/L	0.1 mg/L

Note that since the untreated TCLP concentrations of arsenic, chromium and nickel were already relatively low, the 95% reduction values are extremely low. Specifically, as previously listed, all of these 95% criteria are below or very near the federal drinking water maximum contaminant levels, with the exception of lead. Additionally, verification as to the exact concentration of either arsenic or chromium down to the 95% criteria is very difficult and may be possible only under optimum conditions.

Based on the previously listed criteria, a review of the treated materials indicates that all treated materials exhibited TCLP arsenic concentrations at below a detection limit of 0.015 mg/L. TCLP chromium concentrations for the treated materials ranged from 0.027 mg/L to 0.083 mg/L. TCLP lead concentrations were all found well below the 95% criteria of 0.715 mg/L. Specifically, TCLP lead concentrations ranged from less than a detection limit of 0.010 mg/L to 0.014 mg/L. TCLP nickel concentrations were also detected well below the 95% criteria of 0.113 mg/L. Specifically, TCLP nickel concentrations were detected at concentrations ranging from 0.024 mg/L to 0.042 mg/L.

Note that all treated materials performed very similarly based on analytical evaluations. None of the six treated materials were capable of achieving the TCLP arsenic or chromium criteria due to the extremely low 95% reduction values. With regards to arsenic, lowering of the detection limit below the reported value was not possible. The reported detection limit for arsenic represents the limits of the laboratory equipment. As for the chromium 95% reduction value, 0.0065 mg/L is approximately 15 times lower than the federal drinking water maximum contaminant level (MCL), and may only be obtained under optimum conditions. As a result, the TCLP chromium concentrations exhibited by the treated materials are approximately 15 times lower than those required by federal drinking water standards.

The results of permeability testing are included in Table 5. The results indicate that all treated materials achieved the permeability requirement of less than 1.0×10^{-6} cm/sec. Specifically, hydraulic conductivity values ranged from 2.5×10^{-7} to less than 1.0×10^{-9}. Note that two of the six treated materials include estimated results of less than 1.0×10^{-9} cm/sec. These results are estimated due to the physical contstraints of the equipment. Water movement was not detected through these samples over a two day period. At this time, permeability testing was terminated and an estimate was recorded.

Based on the results of the treatability, although none of the treated materials specifically achieved the 95% reduction values for chromium or arsenic, Kiber believes that the most cost effective treatment that exhibited effective treatment includes the mixture developed with a 5% addition rate of Type I Portland cement. This treated material achieved the permeability and unconfined compressive strength criteria and successfully reduced TCLP lead and nickel concentrations to the 95% criteria. Arsenic concentrations may have been lowered, however, the reduction could not be verified due to the constraints of the laboratory equipment. Additionally, TCLP chromium concentrations were lowered significantly, however, not to the 95% criteria which is 15 times lower than the federal drinking water MCL. Kiber based cost effectiveness on the following approximate unit costs.

Reagents	Approximate Cost per Ton
Type I Portland Cement	$85
Class "C" Fly Ash	$30
Concentrated Phosphoric Acid (85%)	$300

CLOSURE

Kiber Environmental Services, Inc. appreciates the opportunity to provide treatability services to Roy F. Weston, Inc. If you have any questions, or require additional information, please contact either of the undersigned at (770) 242-4090.

Sincerely,
KIBER ENVIRONMENTAL SERVICES, INC.

George M. Zaharchak
Project Manager
(Ext. 250)

Robert K. Semenak
Treatability Department Manager
Associate
(Ext. 235)

attachments

KIBER
ENVIRONMENTAL
SERVICES

TABLES

KIBER ENVIRONMENTAL SERVICES, INC.
ROY F. WESTON, INC.
TECHALLOY TREATABILITY STUDY

TABLE 1
Task 1: Untreated Material Characterization
Summary of Total Volatile Organic Analyses - EPA Method 8260B

ANALYTICAL PARAMETER	RESULTS (ug/kg)	
	Conc.	DL
I. TOTAL VOLATILES		
Acetone	-	59
Acrolein	-	59
Acrylonitrile	-	59
Benzene	-	6
Bromobenzene	-	6
Bromochloromethane	-	6
Bromodichloromethane	-	6
Bromoform	-	6
Bromomethane	-	6
n-Butylbenzene	-	6
s-Butylbenzene	-	6
t-Butlybenzene	-	6
Carbon disulfide	-	6
Carbon tetrachloride	-	6
Chlorobenzene	-	6
Chloroethane	-	6
2-Chloroethyl vinyl ether	-	6
Chloroform	-	6
Chloromethane	-	6
2-Chlorotoluene	-	6
4-Chlorotoluene	-	6
1,2-Dibromo-3-Chloropropane	-	6
1,2-Dibromoethane	-	6
Dibromochloromethane	-	6
Dibromomethane	-	6
1,2-Dichlorobenzene	-	6
1,3-Dichlorobenzene	-	6
1,4-Dichlorobenzene	-	6
trans-1,4-Dichloro-2-butene	-	6
Dichlorodifluoromethane	-	6
1,1-Dichloroethane	-	6
1,2-Dichloroethane	-	6
1,1-Dichloroethene	-	6
cis-1,2-Dichloroethene	-	6
trans-1,2-Dichloroethene	-	6

KIBER ENVIRONMENTAL SERVICES, INC.
ROY F. WESTON, INC.
TECHALLOY TREATABILITY STUDY

TABLE 1
Task 1: Untreated Material Characterization
Summary of Total Volatile Organic Analyses - EPA Method 8260B

ANALYTICAL PARAMETER	RESULTS (ug/kg)	
	Conc.	DL
I. TOTAL VOLATILES		
1,2-Dichloropropane	-	6
1,3-Dichloropropane	-	6
2,2-Dichloropropane	-	6
cis-1,3-Dichloropropene	-	6
trans-1,3-Dichloropropene	-	6
1,1-Dichloropropene	-	6
Ethylbenzene	-	6
Hexachlorobutadiene	-	6
2-Hexanone	-	6
Iodomethane	-	6
Isopropyl benzene	-	6
p-isopropyltoluene	-	6
Methyl ethyl ketone (MEK)	-	59
4-Methyl-2-pentanone (MIBK)	-	6
Methylene chloride	-	6
n-Propyl benzene	-	6
Styrene	-	6
1,1,1,2-Tetrachloroethane	-	6
1,1,2,2-Tetrachloroethane	-	6
Tetrachloroethene	7	6
Toluene	-	6
1,2,3-Trichlorobenzene	-	6
1,2,4-Trichlorobenzene	-	6
1,1,1-Trichloroethane	-	6
1,1,2-Trichloroethane	-	6
Trichloroethene	-	6
Trichlorofluoromethane	-	6
1,2,3-Trichloropropane	-	6
1,2,4-Trimethylbenzene	-	6
1,3,5-Trimethylbenzene	-	6
Vinyl Acetate	-	6
Vinyl Chloride	-	6
m-Xylene / p-Xylene	-	6
o-Xylene	-	6

DL Detection Limit
\- Non Detectable concentrations

3202_205

KIBER ENVIRONMENTAL SERVICES, INC.
ROY F. WESTON, INC.
TECHALLOY TREATABILITY STUDY

TABLE 2
Task 1: Untreated Material Characterization
Summary of Additional Chemical and Physical Analyses

ANALYTICAL PARAMETER	UNIT	RESULTS (1) A	B	C
I. CHEMICAL ANALYSES				
TCLP Arsenic	mg/L	< 0.01	-	-
TCLP Chromium	mg/L	0.13	-	-
TCLP Nickel	mg/L	2.26	-	-
TCLP Lead	mg/L	14.3	-	-
Hexavalent Chromium	mg/kg	< 10	-	-
Material pH	s.u.	6.3	6.2	6.3
II. PHYSICAL PROPERTIES				
Moisture Content, Dry Basis	%	18	17	17
Bulk Density	lb/ft^3	136	134	136
Bulk Specific Gravity	-	2.2	2.1	2.2
Permeability	cm/sec	3.9E-04	-	-
Unconfined Compressive Strength	lbs/in^2	8	-	-
Atterberg Limits			-	-
- Plastic Limit	-	NP	-	-
- Liquid Limit	-	NL	-	-
- Plasticity Index	-	-	-	-
Particle Size Analysis				
- Gravel	%	10	-	-
- Sand	%	76	-	-
- Silt	%	8	-	-
- Clay	%	6	-	-
Soil Classification				
- USCS	-	SM	-	-
- AASHTO	-	A-2-4 (0.1)	-	-
Proctor				
- Maximum Dry Density	lbs/ft^3	122	-	-
- Optimum Moisture Content	%	11.2	-	-

(1) A, B and C represent triplicate aliquots of the untreated material.
- Not Applicable or Not Analyzed
NP No Plastic Limit
NL No Liquid Limit

KIBER ENVIRONMENTAL SERVICES, INC.
ROY F. WESTON, INC.
TECHALLOY TREATABILITY STUDY

TABLE 3
Task II: Stabilization Treatment
Summary of Unconfined Compressive Strength - ASTM D 2166

KIBER SAMPLE No.	REAGENT TYPE (1)	REAGENT ADDITION (%) (3)	WATER ADDITION (%) (3)	CURE INTERVAL (Days)	UNCONFINED COMPRESSIVE STRENGTH TESTING (UCS) Moisture Content (%)	Bulk Density (lbs/ft³)	Dry Density (lbs/ft³)	UCS (lbs/in²)
3202-001	Type I Portland Cement	5	2.5	2	14	133	117	130
				28	14	136	119	301
3202-002	Type I Portland Cement	15	7.5	2	17	134	114	611
				28	17	132	114	1,159
3202-003	Type I Portland Cement	25	12.5	2	18	131	111	1,049
				28	17	129	111	1,502
3202-004	Type I Portland Cement / Class "C" Fly Ash	5 / 10	7.5	2	17	128	109	240
				28	16	127	109	841
3202-005	Type I Portland Cement / Class "C" Fly Ash	10 / 10	10	2	19	128	107	420
				28	17	127	109	1,252
3202-006	10% Phosphoric Acid / Type I Portland Cement (2)	10 / 15	5	2	21	133	110	3
				28	18	129	109	508

(1) All mixtures were developed by blending the reagents dry and slurrying with water prior to addition.
(2) Phosphoric acid was added directly to the untreated material and blended. After mixing, cement was added directly to the mixture and blended.
(3) For a mixture with a 5% reagent addition rate and a 5% water addition rate, 10 grams of reagent was slurried with 10 grams of water and added to 200 grams of untreated material and blended.

KIBER ENVIRONMENTAL SERVICES, INC.
ROY F. WESTON, INC.
TECHALLOY TREATABILITY STUDY

TABLE 4
Task II: Stabilization Treatment
Summary of TCLP Metals Analyses - EPA Methods 1311/6010B

KIBER SAMPLE No.	REAGENT TYPE (1)	REAGENT ADDITION (%) (3)	WATER ADDITION (%) (3)	RESULTS (mg/L) (4)			
				TCLP Arsenic	TCLP Chromium	TCLP Lead	TCLP Nickel
3202-001	Type I Portland Cement	5	2.5	< 0.015	0.031	0.014	0.029
3202-002	Type I Portland Cement	15	7.5	< 0.015	0.027	0.012	0.024
3202-003	Type I Portland Cement	25	12.5	< 0.015	0.083	0.011	0.029
3202-004	Type I Portland Cement / Class "C" Fly Ash	5 / 10	7.5	< 0.015	0.061	0.011	0.025
3202-005	Type I Portland Cement / Class "C" Fly Ash	10 / 10	10	< 0.015	0.034	< 0.010	0.033
3202-006	10% Phosphoric Acid / Type I Portland Cement (2)	10 / 15	5	< 0.015	0.071	0.014	0.042

(1) All mixtures were developed by blending the reagents dry and slurrying with water prior to addition to the untreated material.
(2) Phosphoric acid was added directly to the untreated material and blended. After mixing, cement was added directly to the mixture and blended.
(3) For a mixture with a 5% reagent addition rate and a 5% water addition rate, 10 grams of reagent was slurried with 10 grams of water and added to 200 grams of untreated material and blended.
(4) TCLP analyses were performed after 28 days of curing.

KIBER ENVIRONMENTAL SERVICES, INC.
ROY F. WESTON, INC.
TECHALLOY TREATABILITY STUDY

TABLE 5
Task II: Stabilization Treatment
Summary of Permeability Testing - ASTM D 5084

KIBER SAMPLE No.	REAGENT TYPE (1)	REAGENT ADDITION (%) (3)	WATER ADDITION (%) (3)	PERMEABILITY TESTING (4)			
				Moisture Content (%)	Bulk Density (lbs/ft³)	Dry Density (lbs/ft³)	Hydraulic Conductivity (cm/sec)
3202-001	Type I Portland Cement	5	2.5	12	128	114	2.5E-07
3202-002	Type I Portland Cement	15	7.5	13	133	117	8.6E-09
3202-003	Type I Portland Cement	25	12.5	15	132	115	< 1.0E-09 (5)
3202-004	Type I Portland Cement / Class "C" Fly Ash	5 / 10	7.5	14	126	110	1.5E-08
3202-005	Type I Portland Cement / Class "C" Fly Ash	10 / 10	10	15	121	105	< 1.0E-09 (5)
3202-006	10% Phosphoric Acid / Type I Portland Cement (2)	10 / 15	5	13	119	106	1.0E-07

(1) All mixtures were developed by blending the reagents dry and slurrying with water prior to addition.
(2) Phosphoric acid was added directly to the untreated material and blended. After mixing, cement was added directly to the mixture and blended.
(3) For a mixture with a 5% reagent addition rate and a 5% water addition rate, 10 grams of reagent was slurried with 10 grams of water and added to 200 grams of untreated material and blended.
(4) Permeability testing was performed after 28 days of curing.
(5) Permeability value estimated due to extremely slow movement of the water columns.

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ATTACHMENT A
CHAIN OF CUSTODY

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON MANAGERS / DESIGNERS / CONSULTANTS

Client: Tech alloy
Est. Final Proj. Sampling Date: 9/27/99
Work Order #: 01989.031.002.0040
Project Contact/Phone #: Rick Swearingen 847 918 4088
AD Project Manager:
QC: Del: TAT:
Date Rec'd: Date Due:
Account #:

Refrigerator #

#/Type Container	Liquid	
	Solid	5
Volume	Liquid	
	Solid	5 gallons
Preservatives		None

ANALYSES REQUESTED →

ORGANIC: VOA | BNA | Pest/PCB | Herb

INORG: Metal | CN

WESTON Analytics Use Only

MATRIX CODES:
S - Soil
SE - Sediment
SO - Solid
SL - Sludge
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
L - EP/TCLP Leachate
WI - Wipe
X - Other
F - Fish

Lab ID	Client ID/Description	Matrix QC Chosen (✓) MS	MSD	Matrix	Date Collected	Time Collected
	Treatability Study Soil			S	9/27/99	14:00

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Special Instructions:

DATE/REVISIONS:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

WESTON Analytics Use Only

Samples were:
1) Shipped ___ or Hand Delivered ___
Airbill # _____
2) Ambient or Chilled
3) Received in Good Condition Y or N
4) Labels Indicate Properly Preserved Y or N
5) Received Within Holding Times Y or N

COC Tape was:
1) Present on Outer Package Y or N
2) Unbroken on Outer Package Y or N
3) Present on Sample Y or N
4) Unbroken on Sample Y or N

COC Record Present Upon Sample Rec't Y or N

Discrepancies Between Samples Labels and COC Record? Y or N
NOTES:

Relinquished by	Received by	Date	Time
WESTON	[signature]	9/28/99	1300

Relinquished by	Received by	Date	Time

RFW 21-21-001/A-7/91

____ L372 ____ L373 ____ L375 ____ L377 ____ L378 Ref# _____ Cooler# _____

381-596a

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ATTACHMENT B
UNTREATED MATERIAL CHARACTERIZATION

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

ANALYTICAL REPORT

Client: **Kiber Environmental Services, Inc**
3145 Medlock Bridge Road
Norcross, GA 30071
Attention: **George Zaharchak**

Project Name: **Tech Alloy**
Project ID: 3202
Received: 9/30/99
Lab Project No. 30419

Report Date: 11/3/99

CASE NARRATIVE

1 The holding times for each sample were met.
2 Where applicable, results & reporting limits are based on wet weight; dry weight calculations available.
3 A 50 gram sample size was used in the TCLP extraction. This is a modification of EPA Method 1311 which normally calls for a 100 gram extraction.

Reviewed by: AMS

Respectfully Submitted,
Randy Brown
Hygeia Laboratories, Inc.

LAB ID	CLIENT ID	MATRIX	COLLECTED
229910	Untreated	SOIL	9/29/99

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

Lab Project No. 30419 Report Date: 11/03/1999

Matrix: Leachate Analysis Date: 10/07/1999 Prep. Date: 10/05/1999 Analyst: XP

Lab ID:	229910	
Client ID:	Untreated	
Analyte	**Result**	**RL**
Arsenic	BRL	0.01
Chromium	0.13	0.05
Nickel	2.26	0.01
Lead	14.3	0.1

Hexavalent Chromium Units: **mg/Kg (ppm) by Dry Weight** Method: **SM 3500-D Mod.**

Matrix: Soil Analysis Date: 10/21/1999 Prep. Date: 10/21/1999 Analyst: HT

Lab ID	Client ID	Result	Report Limit
229910	Untreated	BRL	10

pH of the Leachate Units: **pH Units** Method: **EPA 150.1**

Matrix: Leachate Analysis Date: 10/07/1999 Prep. Date: 10/07/1999 Analyst: RR

Lab ID	Client ID	Result
229910	Untreated	4.8

NOTES:

- Results relate only to the samples tested as received (see chain-of-custody).
- BRL = "Below Reporting Limit"
- RL = "Reporting Limit"
- Dates are presented in the format "month/day/year"

Certifications

Alabama - Lab ID 40970; Arkansas; Connecticut - No. PH 0208Delaware; Florida - No. 97056 (EW), No. 97268 (DW); Georgia - No. 804; Indiana - Lab ID C-GA-01; Kentucky - Lab ID 90053; Maryland - No. 293; North Carolina - No. 409; South Carolina - No. 98012; Tennessee - Lab ID 02827 (DW), UST Program; Virginia - Lab ID 0024

Accreditations

American Association for Laboratory Accreditation (A2LA) - No. 0330-01; American Industrial Hygiene Association (AIHA) - Lab ID 09072

SA[illegible]E [illegible] IN-[illegible]CUS[illegible]DY RECORD

COC#

KIBER ENVIRONMENTAL SERVICES
3145 MEDLOCK BRIDGE ROAD
NORCROSS, GEORGIA 30071
(770) 242-4090 FAX (770) 242-9198

CLIENT NAME:	PROJECT NAME:	KES PROJECT #:
Kiber	Technology	3202

TAT or DUE DATE:	CONTACT:	KES PROJECT MANAGER:	
10/7/99	Greg Z	GMZ	
	PHONE#: EXT. 250	RECEIVING LAB: Hygeia	PO#:

SAMPLED BY:
PRINTED NAME Dan McCoy SIGNATURE [signature] COMPANY KES

SAMPLE NUMBER	SAMPLE DESCRIPTION	SAMPLE DATE/TIME	Sample Matrix	Preservative	# / Size of Cont.	ANALYSES (indicate target list) TCLP Arsenic, Cadmium, Nickel, Lead	TCLP Flash Pt	Hexavalent Chromium						Remarks
Untreated	—	9/29	S	—	1-8oz	X	X	X						7/6

KIBER QA/QC LEVEL REQUESTED: I (II) III IV
CASE NARRATIVE REQUESTED: (YES) NO
PM INITIALS [illegible]

SAMPLES RELINQUISHED BY:	DATE/ TIME	SAMPLES ACCEPTED BY:	DATE/ TIME
[signature]	9/29/99	Michelle Epps	9/30/99

COMMENTS:

REV 4 10/27/98

Dry Weight Results is Default for Soils/Applicable Wastes

h:\treat\coc1.wk4

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

ANALYTICAL REPORT

Client: **Kiber Environmental Services, Inc**
3145 Medlock Bridge Road
Norcross, GA 30071
Attention: **George Zaharchak**

Project Name: **Techalloy**
Project ID: 3202
Received: 10/25/99
Lab Project No. 30783

Report Date: 11/3/99

CASE NARRATIVE

1 The holding times for each sample were met.
2 Where applicable, results & reporting limits are based on wet weight; dry weight calculations available.

Reviewed by:

Respectfully Submitted,

Hygeia Laboratories, Inc.

LAB ID	CLIENT ID	MATRIX	COLLECTED
232625	Untreated	SOIL	10/22/99

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

Lab Project No. 30783 Report Date: 11/3/99

Volatile Organics

Units: **mg/Kg (ppm) by Dry Weight** Method: **EPA 8260B**

Matrix: Soil Analysis Date: 10/27/99 Prep. Date: 10/27/99 Analyst: WET

	Lab ID: 232625	Client ID: Untreated
Analyte	**Result**	**RL**
Acetone	BRL	59
Acrolein	BRL	59
Acrylonitrile	BRL	59
Benzene	BRL	6
Bromobenzene	BRL	6
Bromochloromethane	BRL	6
romodichloromethane	BRL	6
Bromoform	BRL	6
Bromomethane	BRL	6
n-Butylbenzene	BRL	6
s-Butylbenzene	BRL	6
t-Butylbenzene	BRL	6
Carbon Disulfide	BRL	6
Carbon tetrachloride	BRL	6
Chlorobenzene	BRL	6
Chloroethane	BRL	6
2-Chloroethyl vinyl ether	BRL	6
Chloroform	BRL	6
Chloromethane	BRL	6
2-Chlorotoluene	BRL	6
4-Chlorotoluene	BRL	6
1,2-Dibromo-3-Chloropropane	BRL	6
1,2-Dibromoethane	BRL	6
bromochloromethane	BRL	6
Dibromomethane	BRL	6
1,2-Dichlorobenzene	BRL	6
1,3-Dichlorobenzene	BRL	6
1,4-Dichlorobenzene	BRL	6
t-1,4-Dichloro-2-butene	BRL	6
ichlorodifluoromethane	BRL	6
1,1-Dichloroethane	BRL	6
1,2-Dichloroethane	BRL	6
1,1-Dichloroethene	BRL	6
c-1,2-Dichloroethene	BRL	6
t-1,2-Dichloroethene	BRL	6
1,2-Dichloropropane	BRL	6
1,3-Dichloropropane	BRL	6
2,2-Dichloropropane	BRL	6

continued next page

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

Lab Project No. 30783 Report Date: 11/3/99

Volatile Organics (continued)

Units: **mg/Kg (ppm) by Dry Weight** Method: **EPA 8260B**

Matrix: Soil Analysis Date: 10/27/99 Prep. Date: 10/27/99 Analyst: WET

	Lab ID:	232625	
	Client ID:	Untreated	
Analyte	**Result**		**RL**
c-1,3-Dichloropropene	BRL		6
t-1,3-Dichloropropene	BRL		6
1,1-Dichloropropene	BRL		6
Ethylbenzene	BRL		6
Hexachlorobutadiene	BRL		6
2-Hexanone	BRL		6
Iodomethane	BRL		6
Isopropylbenzene	BRL		6
p-Isopropyltoluene	BRL		6
Methyl ethyl ketone (MEK)	BRL		59
4-Methyl-2-pentanone (MIBK)	BRL		6
Methylene chloride	7		6
n-Propylbenzene	BRL		6
Styrene	BRL		6
,1,1,2-Tetrachloroethane	BRL		6
1,1,2,2-Tetrachloroethane	BRL		6
Tetrachloroethene	BRL		6
Toluene	BRL		6
1,2,3-Trichlorobenzene	BRL		6
2,4-Trichlorobenzene	BRL		6
1,1,1-Trichloroethane	BRL		6
1,1,2-Trichloroethane	BRL		6
Trichloroethene	BRL		6
ichlorofluoromethane	BRL		6
,2,3-Trichloropropane	BRL		6
1,2,4-Trimethylbenzene	BRL		6
1,3,5-Trimethylbenzene	BRL		6
Vinyl Acetate	BRL		6
Vinyl chloride	BRL		6
m-Xylene/p-Xylene	BRL		6
o-Xylene	BRL		6

Surrogate Recoveries	
bromofluoromethane	98 %
1,2-Dichloroethane-d4	97 %
Toluene-d8	102 %
4-Bromofluorobenzene	108 %
,2-Dichlorobenzene-d4	99 %

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Lab Project No. 30783

Report Date: 11/3/99

NOTES:

- Results relate only to the samples tested as received (see chain-of-custody).
- BRL = "Below Reporting Limit"
- RL = "Reporting Limit"
- Dates are presented in the format "month/day/year"

Certifications

Alabama - Lab ID 40970; Arkansas; Connecticut - No. PH 0208Delaware; Florida - No. 97056 (EW), No. 97268 (DW); Georgia - No. 804; Indiana - Lab ID C-GA-01; Kentucky - Lab ID 90053; Maryland - No. 293; North Carolina - No. 409; South Carolina - No. 98012; Tennessee - Lab ID 02827 (DW), UST Program; Virginia - Lab ID 0024

Accreditations

American Association for Laboratory Accreditation (A2LA) - No. 0330-01; American Industrial Hygiene Association (AIHA) - Lab ID 09072

KIBER ENVIRONMENTAL SERVICES

SAMPLE CHAIN-OF-CUSTODY RECORD

COC#

3145 MEDLOCK BRIDGE ROAD
NORCROSS, GEORGIA 30071
(770) 242-4090 FAX (770) 242-9198

CLIENT NAME:	PROJECT NAME:	KES PROJECT #:
Kiber	Techalloy	3202

TAT or DUE DATE:	CONTACT:	KES PROJECT MANAGER:	
10/29/98	COMZ	GMZ	
	PHONE#: EXT.	RECEIVING LAB: Hygeia	PO#: 8722

SAMPLED BY: Mark Gilbert (PRINTED NAME) (SIGNATURE) (COMPANY)

SAMPLE NUMBER	SAMPLE DESCRIPTION	SAMPLE DATE/TIME	Sample Matrix	Preserva-tive	# / Size of Cont.	ANALYSES (indicate target list): 10xq VOAs	Remarks
Untreated	—	10/22/98	S	—	1-4oz	X	232625

KIBER QA/QC LEVEL REQUESTED: I (II) III IV

CASE NARRATIVE REQUESTED: (YES) NO

PM INITIALS: GMZ

SAMPLES RELINQUISHED BY:	DATE/TIME	SAMPLES ACCEPTED BY:	DATE/TIME	COMMENTS:
Mark Gilbert	10/25/98 1500	Randy Brown	10/25/98 1500	

REV 4 10/27/98

Dry Weight Results is Default for Soils/Applicable Wastes

h:\mea\coc1.wk4

MATERIAL pH

EPA METHOD 9045
DATA SHEET

PROJECT:	TECHALLOY
PROJECT No.:	3202
TESTING DATE:	30 SEPTEMBER 1999
TESTED BY:	DM
TRACKING CODE:	9413_PH

KIBER SAMPLE No.		MATERIAL pH
1.	UN 2291A	6.28
2.	UN 2291B	6.23
3.	UN 2291C	6.31
4.		
5.		
6.		
7.		
8.		
9.		
10.		

MOISTURE CONTENT DETERMINATION

REPORT FORM

PROJECT:	TECHALLOY
PROJECT No.:	3202
SAMPLE No.:	UN 2291
TESTING DATE:	30 SEPTEMBER 1999
TESTED BY:	DM
TRACKING CODE:	9413_MC

MOISTURE CONTENT (Dry & Wet Basis)			
1. MOISTURE TIN NO.	A	B	C
2. WT MOISTURE TIN (tare weight)	1.30 g	1.30 g	1.30 g
3. WT WET SOIL + TARE	46.95 g	47.05 g	42.22 g
4. WT DRY SOIL + TARE	40.14 g	40.50 g	36.37 g
5. WT WATER, Ww	6.81 g	6.55 g	5.85 g
6. WT DRY SOIL, Ws	38.84 g	39.20 g	35.07 g
7. ASTM MOISTURE CONTENT, W	17.53 %	16.71 %	16.68 %
8. EPA MOISTURE CONTENT, W	14.92 %	14.32 %	14.30 %

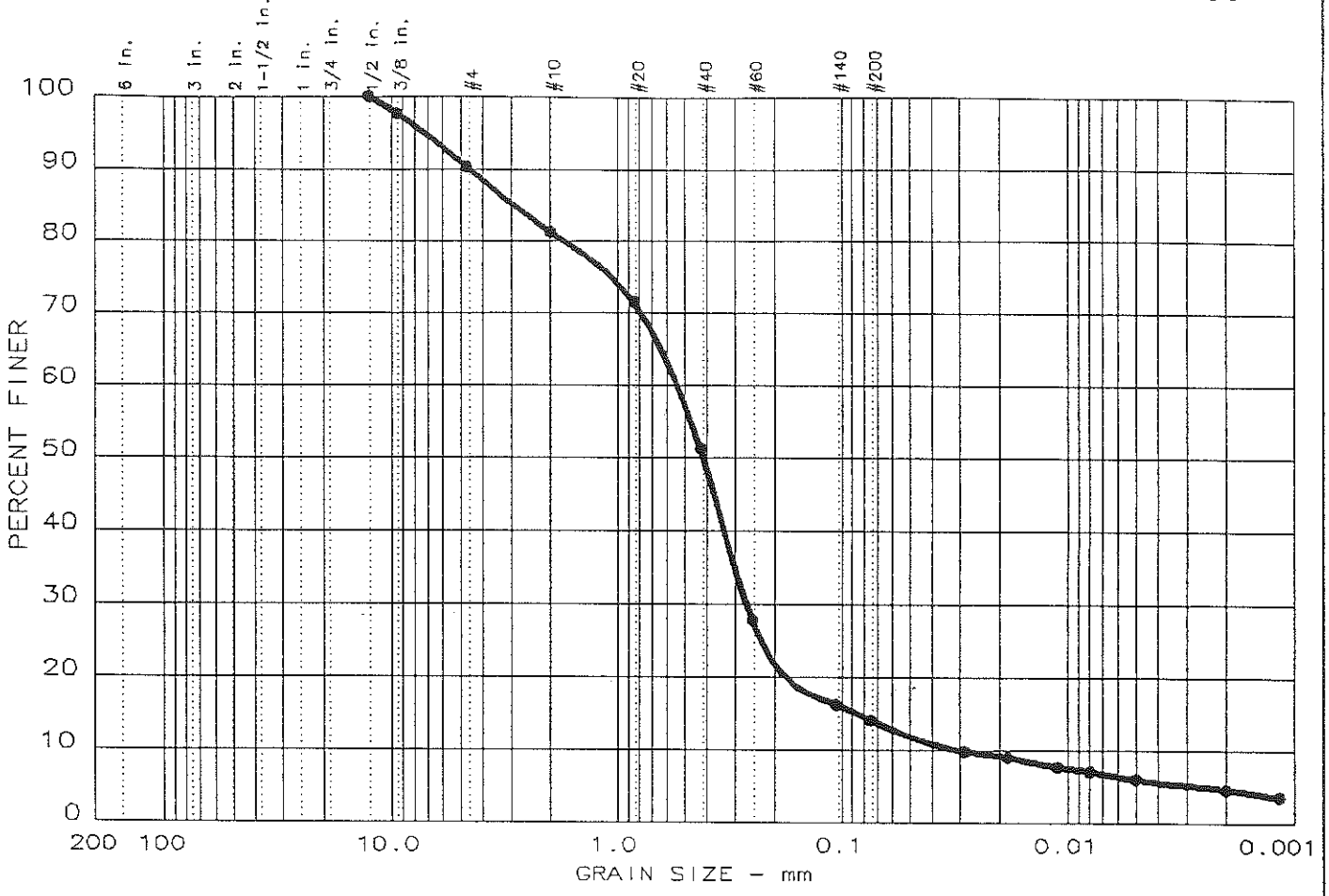
UNIT WEIGHT DETERMINATION

DATA SHEET

PROJECT:	TECHALLOY
PROJECT No.:	3202
SAMPLE No.:	UN 2291
TESTING DATE:	30 SEPTEMBER 1999
TESTED BY:	DM
TRACKING CODE:	9413_UW

UNIT WEIGHT (DENSITY)			
1. SAMPLE NO.	A	B	C
2. WT OF MOLD (tare weight)	20.84 g	21.11 g	21.11 g
3. WT OF MOLD + SOIL	469.31 g	462.78 g	469.71 g
4. WT OF WET SOIL, W	448.47 g	441.67 g	448.60 g
5. DIAMETER OF SPECIMEN, D	2.00 in	2.00 in	2.00 in
6. HEIGHT OF SPECIMEN, H	4.00 in	4.00 in	4.00 in
7. VOLUME OF SPECIMEN	12.57 in^3	12.57 in^3	12.57 in^3
8. BULK UNIT WEIGHT	136.0 pcf	133.9 pcf	136.0 pcf
9. BULK SPECIFIC GRAVITY	2.2	2.1	2.2

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	18	0.0	9.7	76.2	8.1	6.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NL	NP	2.92	0.536	0.412	0.265	0.0838	0.0298	4.41	18.0

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Silty Sand	SM	A-2-4(0.1)

Project No.: 3202
Project: Tech Alloy
● Location: Utreated

Date: 29 September 1999

KIBER
ENVIRONMENTAL
SERVICES, INC.

Remarks:

Figure No. _____

MOISTURE-DENSITY RELATIONSHIP TEST

Curve No.:

Project No.: 3202
Project: Tech Alloy
Location: Untreated

Date: 6 October 1999

Elev/Depth:
Remarks:

MATERIAL DESCRIPTION

Description:
Classifications: USCS: AASHTO:
Nat. Moist. = % Sp.G. =
Liquid Limit = Plasticity Index =

TEST RESULTS
Maximum dry density = 121.9 pcf
Optimum moisture = 11.2 %

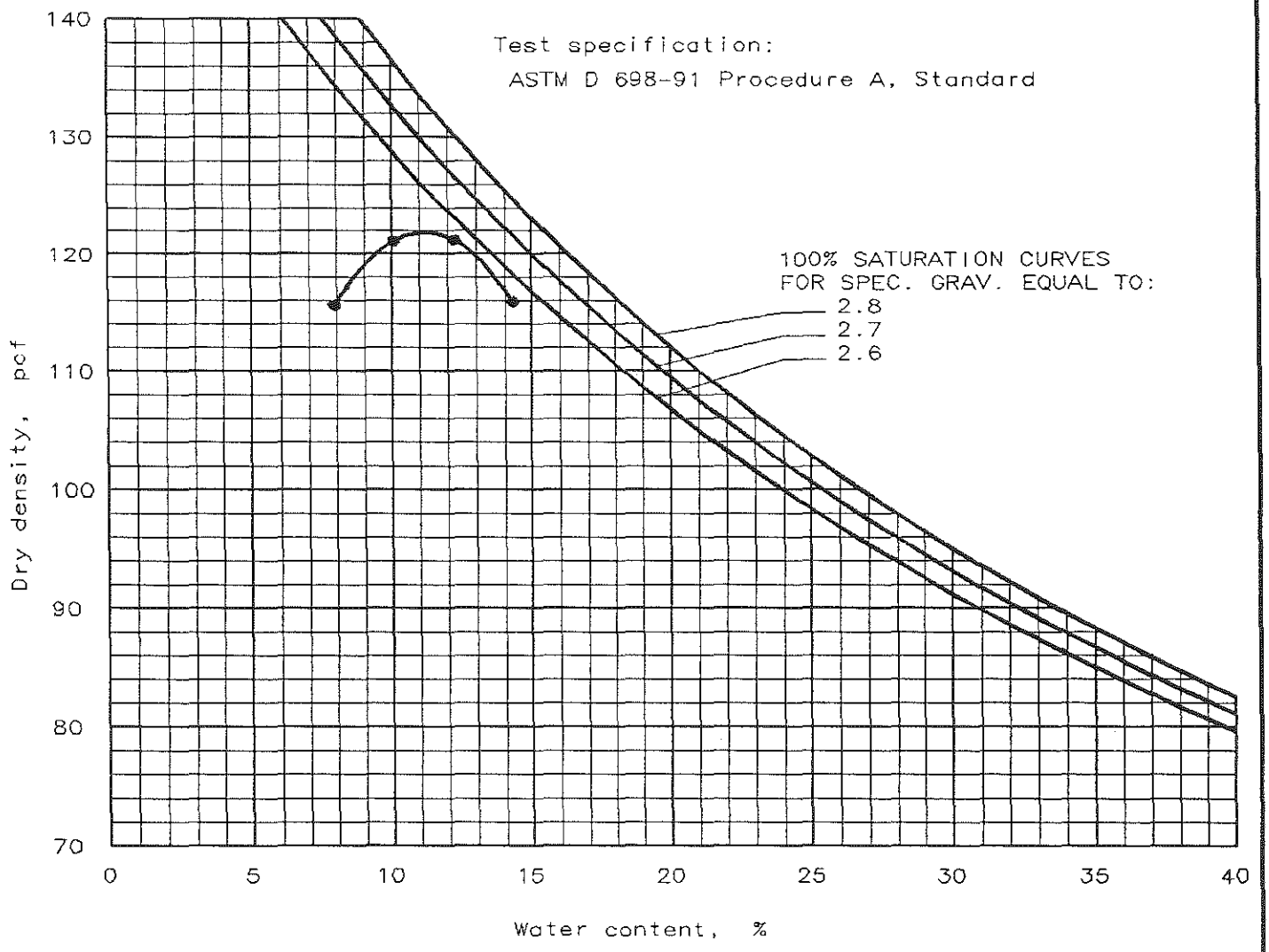


Plate No. 1

KIBER ENVIRONMENTAL SERVICES, INC.

UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECH ALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	UNTREATED	DIAL GAGE:	LDT 2
TESTING DATE:	7 OCTOBER 1999	LOADING RATE:	0.056 in./min.
TESTED BY:	DM	TRACKING CODE:	9440_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	12.0	**%**
BULK UNIT WEIGHT	123.9	**pcf**
DRY UNIT WEIGHT	110.7	**pcf**
UCS •	7.5	**psi**

• UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECH ALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	UNTREATED	DIAL GAGE:	LDT 2
TESTING DATE:	7 OCTOBER 1999	LOADING RATE:	0.056 in./min.
TESTED BY:	DM	TRACKING CODE:	9440 US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	UN 2291	
2. WT MOISTURE TIN (tare weight)	1.28	g
3. WT WET SOIL + TARE	32.51	g
4. WT DRY SOIL + TARE	29.17	g
5. WT WATER, Ww	3.34	g
6. WT DRY SOIL, Ws	27.89	g
7. MOISTURE CONTENT, W	**11.98**	**%**

SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.87 in.	5.60 in.
No. 2	2.87 in.	5.61 in.
No. 3	2.87 in.	5.62 in.
Average	**2.87 in.**	**5.61 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***1180.67 g***
Initial Area, Ao	6.47 in^2
Initial Volume, Vo	36.29 in^3
Initial Bulk Unit Weight,	123.9 pcf
Initial Dry Unit Weight	110.7 pcf
15 % Strain (0.15 Lo)	0.84 in.
UCS	7.5 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	6.469	0.0000	0.0
2	0.003	0.003	6.473	0.0005	0.3
3	0.005	0.005	6.475	0.0009	0.5
5	0.007	0.007	6.477	0.0012	0.8
5	0.010	0.010	6.481	0.0018	0.8
7	0.015	0.015	6.487	0.0027	1.1
10	0.020	0.020	6.492	0.0036	1.5
12	0.025	0.025	6.498	0.0045	1.8
15	0.030	0.030	6.504	0.0053	2.3
16	0.035	0.035	6.510	0.0062	2.5
20	0.040	0.040	6.516	0.0071	3.1
24	0.045	0.045	6.522	0.0080	3.7
26	0.050	0.050	6.527	0.0089	4.0
28	0.055	0.055	6.533	0.0098	4.3
30	0.060	0.060	6.539	0.0107	4.6
31	0.065	0.065	6.545	0.0116	4.7
35	0.070	0.070	6.551	0.0125	5.3
36	0.075	0.075	6.557	0.0134	5.5
38	0.080	0.080	6.563	0.0143	5.8
40	0.085	0.085	6.569	0.0152	6.1
41	0.090	0.090	6.575	0.0160	6.2
43	0.095	0.095	6.581	0.0169	6.5
45	0.100	0.100	6.587	0.0178	6.8
46	0.105	0.105	6.593	0.0187	7.0
48	0.115	0.115	6.605	0.0205	7.3
50	0.130	0.130	6.623	0.0232	7.5
48	0.140	0.140	6.635	0.0250	7.2
46	0.150	0.150	6.647	0.0267	6.9
45	0.160	0.160	6.659	0.0285	6.8
43	0.170	0.170	6.671	0.0303	6.4

PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450 PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	124.9 pcf	132.9 pcf
DRY UNIT WEIGHT	110.6 pcf	115.4 pcf
MOISTURE CONTENT	12.9 %	15.2 %
PERMEABILITY @ 20°C	3.9E-04 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450_PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	UN-2271	UN-2271
2. WT MOISTURE TIN (tare weight)	0.00 g	210.55 g
3. WT WET SOIL + TARE	605.20 g	827.80 g
4. WT DRY SOIL + TARE	535.95 g	746.50 g
5. WT WATER, Ww	69.25 g	81.30 g
6. WT DRY SOIL, Ws	535.95 g	535.95 g
7. MOISTURE CONTENT, W	12.92 %	15.17 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.87 in.*	*2.89 in.*	*2.85 in.*	*2.71 in.*
No. 2	*2.87 in.*	*2.89 in.*	*2.86 in.*	*2.69 in.*
No. 3	*2.87 in.*	*2.89 in.*	*2.85 in.*	*2.69 in.*
Average	2.87 in.	2.89 in.	2.85 in.	2.70 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*605.20 g*	*617.25 g*
Area, Ao	6.47 in^2	6.56 in^2
Volume, Vo	18.46 in^3	17.69 in^3
Bulk Unit Weight	124.9 pcf	132.9 pcf
Dry Unit Weight	110.6 pcf	115.4 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450_PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
10/7/99	13 : 30	MC	7.0	5.0	5.5				
10/7/99	14 : 1	MC	17.0	15.0	15.3	8.5	10.0	3.0	0.30
10/7/99	14 : 38	MC	27.0	25.0	25.3	19.6	10.0	4.3	0.43
10/7/99	15 : 40	MC	37.0	35.0	35.3	30.3	10.0	5.0	0.50
10/7/99	16 : 10	MC	47.0	45.0	45.3	41.6	10.0	6.3	0.63
10/7/99	17 : 4	MC	57.0	55.0	55.7	53.0	10.0	7.7	0.77
10/7/99	18 : 5	MC	67.0	65.0	65.8	63.8	10.0	8.1	0.81
10/8/99	8 : 21	MC	77.0	75.0	*	75.0	10.0	9.2	0.92
10/8/99	8 : 21	MC	66.0	65.0	65.8	*	*	*	*
10/8/99	9 : 45	MC	76.0	75.0	75.8	75.2	10.0	9.4	0.94
10/8/99	10 : 31	MC	86.0	85.0	*	85.4	10.0	9.6	0.96
10/8/99	10 : 31	MC	77.0	75.0	*	*	*	*	*

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450_PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		

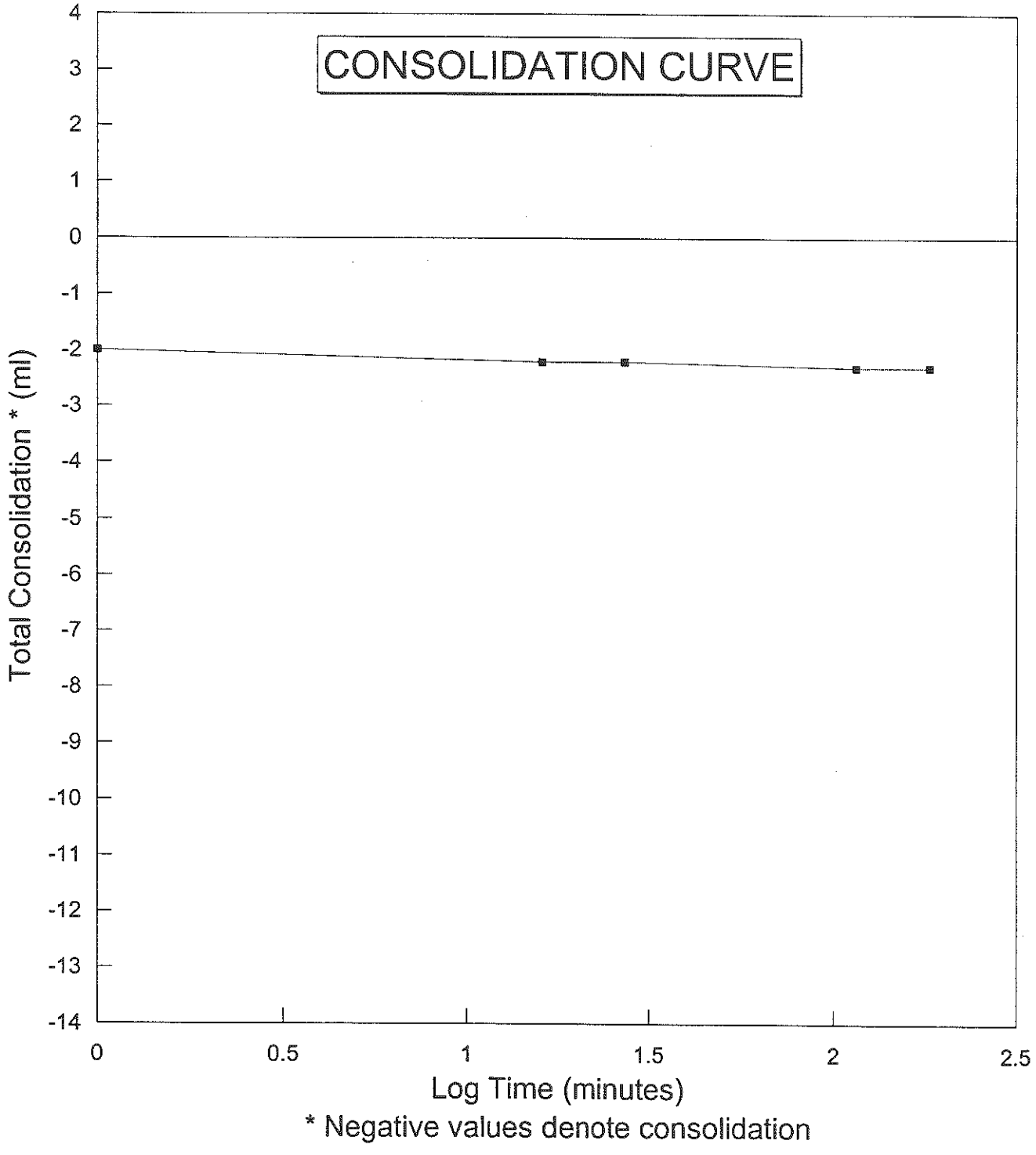
CELL PRESSURE: 85 psi **BACK PRESSURE:** 75 psi **EFFECTIVE STRESS:** 10 psi

TEST DATE	*TESTED BY*	*TIME (Military)*	*ELAPSED TIME (minutes)*	*TOTAL TIME (minutes)*	*TOTAL TIME (Log)*	*SPECIMEN CONSOLIDATION (ml)*				
						READING			*ACTUAL*	
						CELL	*BOTTOM*	*TOP*	*CELL (Cc)*	*TOTAL (Ct)*
10 / 8 / 99	MC	10 : 37				0.0	24.0	24.0	0.0	0.0
10 / 8 / 99	MC	10 : 38	1	1	0.00	1.9	23.0	23.0	1.9	2.0
10 / 8 / 99	MC	10 : 53	15	16	1.20	2.4	23.0	22.8	2.4	2.2
10 / 8 / 99	MC	11 : 4	11	27	1.43	2.7	23.0	22.8	2.7	2.2
10 / 8 / 99	MC	12 : 32	88	115	2.06	4.0	22.9	22.8	4.0	2.3
10 / 8 / 99	MC	13 : 40	68	183	2.26	4.0	22.9	22.8	4.0	2.3

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450 PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		



PERMEABILITY

TEST DATA

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450 PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		

				HYDRAULIC HEAD (cm)			GAUGE PRESSURE (psi)		
DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	INFLUENT	EFFLUENT	TEMP. C°	CELL	INFLUENT	EFFLUENT
10 / 8 /99	MC	12 : 58		0.0	24.0	20.0	85.0	75.0	75.0
10 / 8 /99	MC	12 : 59	1	3.0	21.0	20.0	85.0	75.0	75.0
10 / 8 /99	MC	13 : 0	1	5.1	19.0	20.0	85.0	75.0	75.0
10 / 8 /99	MC	13 : 1	1	6.7	17.3	20.0	85.0	75.0	75.0
10 / 8 /99	MC	13 : 2	1	7.9	16.1	20.0	85.0	75.0	75.0
10 / 8 /99	MC	13 : 12	RESET	0.0	24.0	20.0	85.0	75.0	75.0
10 / 8 /99	MC	13 : 15	3	6.7	17.2	20.0	85.0	75.0	75.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	TECH ALLOY	TESTED BY:	CLG
PROJECT No.:	3202	TRACKING CODE:	9450 PM
SAMPLE No.:	UNTREATED	EQUIPMENT No.:	1
TEST DATE:	7 OCTOBER 1999		

ELAPSED TIME	*HYDRAULIC HEAD DIFFERENCE (cm)*		*EFFLUENT - INFLUENT*	*HYDRAULIC GRADIENT*	*HYDRAULIC CONDUCTIVITY (cm/sec)*	
(minutes)	*INFLUENT*	*EFFLUENT*	*RATIO*	*(cm/cm)*	*@ Temp.*	*@ 20° C*
RESET				3.312		
1	3.0	3.0	1.00	2.484	4.16E-04	4.16E-04
1	2.1	2.0	0.95	1.918	3.74E-04	3.74E-04
1	1.6	1.7	1.06	1.463	3.92E-04	3.92E-04
1	1.2	1.2	1.00	1.131	3.71E-04	3.71E-04
RESET				3.312		
3	6.7	6.8	1.01	1.449	3.99E-04	3.99E-04

KIBER
ENVIRONMENTAL
SERVICES

ATTACHMENT C
STABILIZATION TREATMENT

KIBER
ENVIRONMENTAL
SERVICES

ATTACHMENT C
STABILIZATION TREATMENT

HYGEIA LABORATORIES, INC.
1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

ANALYTICAL REPORT

Client: **Kiber Environmental Services, Inc**
3145 Medlock Bridge Road
Norcross, GA 30071
Attention: **George Zaharchak**

Project Name: **Techalloy**
Project ID: 3202-8754
Received: 11/22/99
Lab Project No. 31169

Report Date: 12/15/99

CASE NARRATIVE

1 The holding times for each sample were met.
2 Where applicable, results & reporting limits are based on wet weight; dry weight calculations available.

Reviewed by:

Respectfully Submitted,

Hygeia Laboratories, Inc.

LAB ID	CLIENT ID	MATRIX	COLLECTED
235085	3202-001 (28 day)	SOIL	11/19/99
235086	3202-002 (28 day)	SOIL	11/19/99
235087	3202-003 (28 day)	SOIL	11/19/99
235088	3202-004 (28 day)	SOIL	11/19/99
235089	3202-005 (28 day)	SOIL	11/19/99
235090	3202-006 (28 day)	SOIL	11/19/99

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

Lab Project No. 31169 Report Date: 12/15/99

TCLP Metals by ICP

Units: mg/L (ppm) Method: EPA1311/6010B

Matrix: Leachate Analysis Date: 12/2/99 Prep. Date: 12/1/99 Analyst: MP

Lab ID:	235086		235087		235088		235089	
Client ID:	3202-001 (28 day)		3202-002 (28 day)		3202-003 (28 day)		3202-004 (28 day)	
Analyte	**Result**	**RL**	**Result**	**RL**	**Result**	**RL**	**Result**	**RL**
Arsenic	BRL	0.015	BRL	0.015	BRL	0.015	BRL	0.015
Chromium	0.031	0.004	0.027	0.004	0.083	0.004	0.061	0.004
Nickel	0.029	0.006	0.024	0.006	0.029	0.006	0.025	0.006
Lead	0.01	0.01	0.12	0.01	0.01	0.01	0.01	0.01

TCLP Metals by ICP

Units: mg/L (ppm) Method: EPA1311/6010B

Matrix: Leachate Analysis Date: 12/2/99 Prep. Date: 12/1/99 Analyst: MP

Lab ID:	235090		235091	
Client ID:	3202-005 (28 day)		3202-006 (28 day)	
Analyte	**Result**	**RL**	**Result**	**RL**
Arsenic	BRL	0.015	BRL	0.015
Chromium	0.034	0.004	0.071	0.004
Nickel	0.033	0.006	0.042	0.006
Lead	BRL	0.01	0.01	0.01

pH of the Leachate

Units: pH Units Method: EPA 150.1

Matrix: Leachate Analysis Date: 12/6/99 Analyst: RK

Lab ID	Client ID	Result
235085	3202-001 (28 day)	11.1
235086	3202-002 (28 day)	11.9
235087	3202-003 (28 day)	12.1
235088	3202-004 (28 day)	11.3
235089	3202-005 (28 day)	11.7
235090	3202-006 (28 day)	11.9

HYGEIA LABORATORIES, INC.

1300 Williams Drive, Suite A - Marietta, Georgia 30066-6299 - (770) 514-6933, FAX (770) 514-6966

Lab Project No. 31169

Report Date: 12/15/99

NOTES:

- Results relate only to the samples tested as received (see chain-of-custody).
- BRL = "Below Reporting Limit"
- RL = "Reporting Limit"
- Dates are presented in the format "month/day/year"

Certifications

Alabama - Lab ID 40970; Arkansas; Connecticut - No. PH 0208Delaware; Florida - No. 97056 (EW), No. 97268 (DW); Georgia - No. 804; Indiana - Lab ID C-GA-01; Kentucky - Lab ID 90053; Maryland - No. 293; North Carolina - No. 409; South Carolina - No. 98012; Tennessee - Lab ID 02827 (DW), UST Program; Virginia - Lab ID 0024

Accreditations

American Association for Laboratory Accreditation (A2LA) - No. 0330-01; American Industrial Hygiene Association (AIHA) - Lab ID 09072

SAMPLE CHAIN-OF-CUSTODY RECORD

COC#

KIBER ENVIRONMENTAL SERVICES
3145 MEDLOCK BRIDGE ROAD
NORCROSS, GEORGIA 30071
(770) 242-4090 FAX (770) 242-9198

CLIENT NAME:	PROJECT NAME:	KES PROJECT #:
Kiber	Techalloy	3202-8754

TAT or DUE DATE:	CONTACT:	KES PROJECT MANAGER:	
11/29/99	GMZ	GMZ	
	PHONE#: EXT.	RECEIVING LAB:	PO#:
		Hyzon	8754

SAMPLED BY: G. Zehnder (PRINTED NAME) (SIGNATURE) Kiber (COMPANY)

SAMPLE NUMBER	SAMPLE DESCRIPTION	SAMPLE DATE/TIME	Sample Matrix	Preserva-tive	# / Size of Cont.	ANALYSES (indicate target list) TCLP Arsenic	Chrome	Nickel	Lead	TCLP Fluoride						Remarks
3202.001 (28 DAY)		11/19/99	S	—	1-4oz	X				X						73-75
3202-002 (28 DAY)						X				X						076
3202.003 (28 DAY)						X				X						077
3202.004 (28 DAY)						X				X						078
3202.005 (28 DAY)						X				X						079
3202.006 (28 DAY)						X				X						080

KIBER QA/QC LEVEL REQUESTED: I II III IV

CASE NARRATIVE REQUESTED: YES NO

PM INITIALS: 9/29

SAMPLES RELINQUISHED BY:	DATE/ TIME	SAMPLES ACCEPTED BY:	DATE/ TIME
	11/19/99		

COMMENTS:

REV 4 10/27/98

Dry Weight Results is Default for Soils/Applicable Wastes

h:\real\coc1.wk4

UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-001 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9543_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	13.7	**%**
BULK UNIT WEIGHT	132.7	**pcf**
DRY UNIT WEIGHT	116.7	**pcf**
UCS *	130.0	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-001 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9543_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	001	
2. WT MOISTURE TIN (tare weight)	1.00	g
3. WT WET SOIL + TARE	21.25	g
4. WT DRY SOIL + TARE	18.81	g
5. WT WATER, Ww	2.44	g
6. WT DRY SOIL, Ws	17.81	g
7. MOISTURE CONTENT, W	**13.70**	**%**

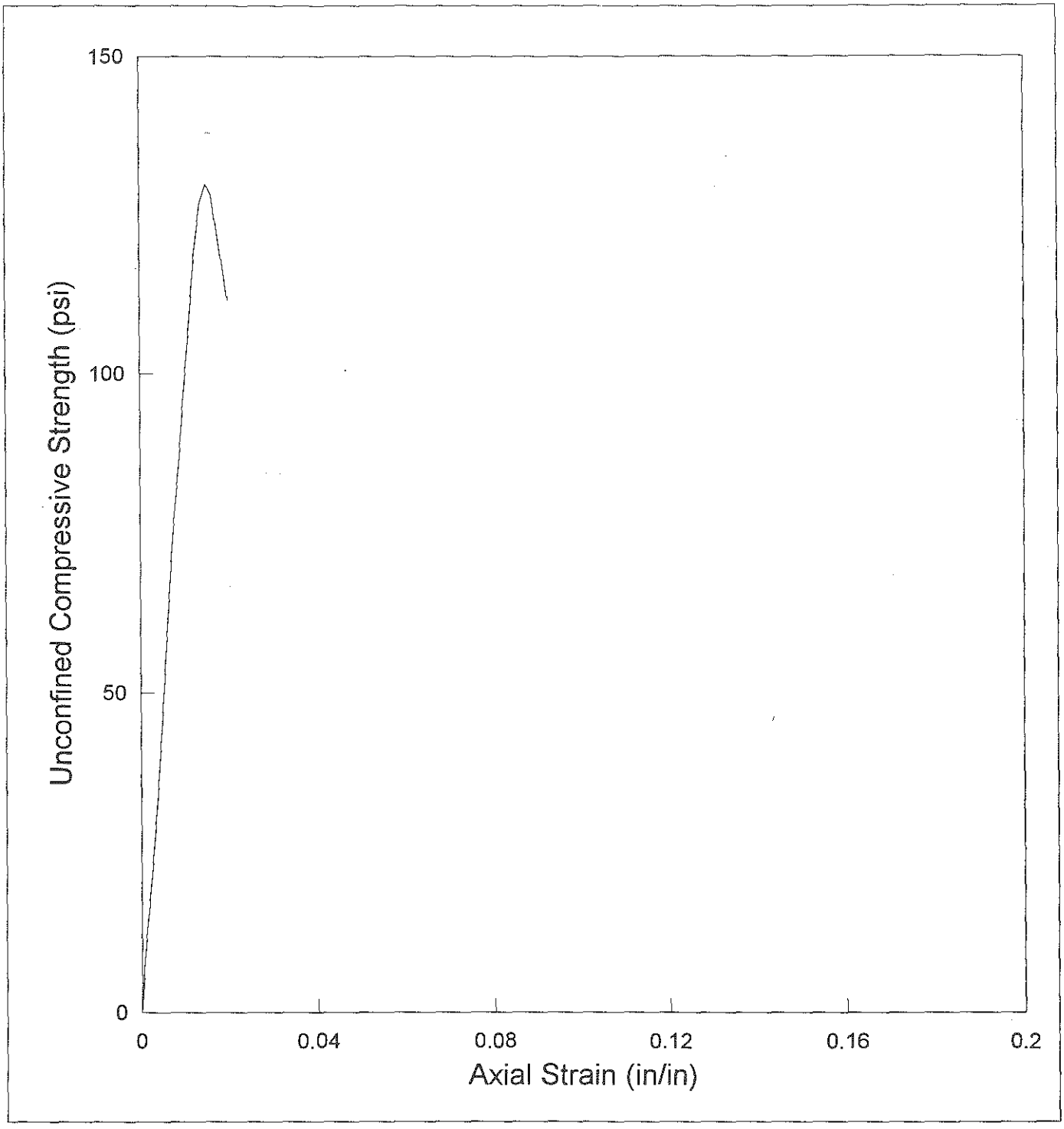
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.01 in.	4.04 in.
No. 2	2.02 in.	4.04 in.
No. 3	2.01 in.	4.03 in.
Average	**2.01 in.**	**4.04 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***447.74 g***
Initial Area, Ao	3.18 in^2
Initial Volume, Vo	12.85 in^3
Initial Bulk Unit Weight,	132.7 pcf
Initial Dry Unit Weight	116.7 pcf
15 % Strain (0.15 Lo)	0.61 in.
UCS	130.0 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.184	0.0000	0.0
26	0.003	0.003	3.186	0.0007	8.2
41	0.005	0.005	3.188	0.0012	12.9
51	0.007	0.007	3.189	0.0017	16.0
71	0.010	0.010	3.192	0.0025	22.2
106	0.015	0.015	3.195	0.0037	33.2
149	0.020	0.020	3.199	0.0050	46.6
197	0.025	0.025	3.203	0.0062	61.5
241	0.030	0.030	3.207	0.0074	75.1
276	0.035	0.035	3.211	0.0087	85.9
311	0.040	0.040	3.215	0.0099	96.7
345	0.045	0.045	3.220	0.0111	107.2
383	0.050	0.050	3.224	0.0124	118.8
410	0.055	0.055	3.228	0.0136	127.0
420	0.060	0.060	3.232	0.0149	130.0
415	0.065	0.065	3.236	0.0161	128.3
397	0.070	0.070	3.240	0.0173	122.5
380	0.075	0.075	3.244	0.0186	117.1
362	0.080	0.080	3.248	0.0198	111.5

UNCONFINED COMPRESSION TESTING

Sample No. 3202-001 (2 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-001 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9644_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	14.3	%
BULK UNIT WEIGHT	136.2	pcf
DRY UNIT WEIGHT	119.2	pcf
UCS *	300.5	psi

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-001 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9644_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	001	
2. WT MOISTURE TIN (tare weight)	0.99	g
3. WT WET SOIL + TARE	30.07	g
4. WT DRY SOIL + TARE	26.44	g
5. WT WATER, Ww	3.63	g
6. WT DRY SOIL, Ws	25.45	g
7. MOISTURE CONTENT, W	**14.26**	**%**

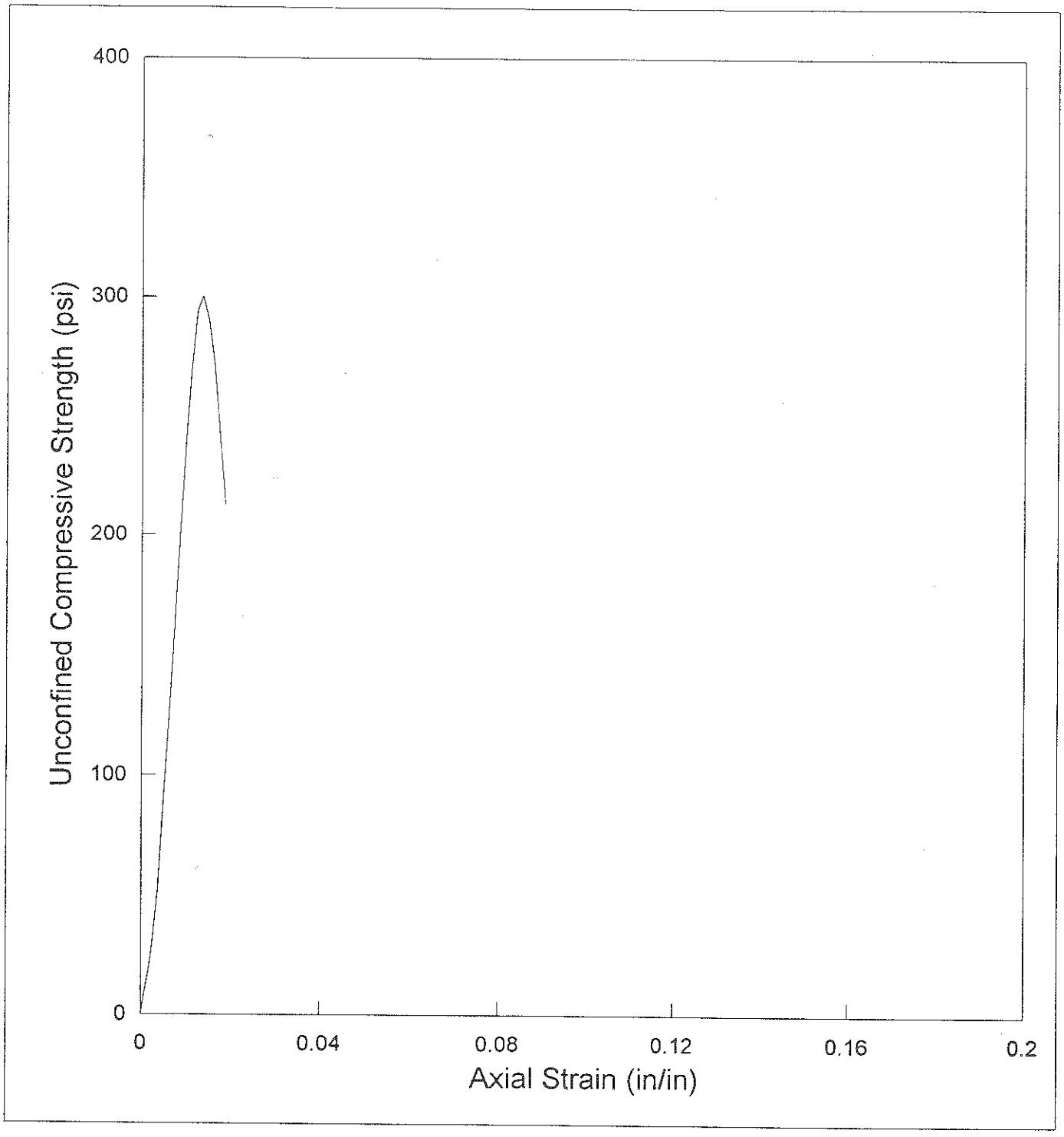
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	1.99 in.	4.01 in.
No. 2	2.01 in.	4.01 in.
No. 3	1.99 in.	4.01 in.
Average	**2.00 in.**	**4.01 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***449.01 g***
Initial Area, Ao	3.13 in^2
Initial Volume, Vo	12.56 in^3
Initial Bulk Unit Weight,	136.2 pcf
Initial Dry Unit Weight	119.2 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	300.5 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.131	0.0000	0.0
26	0.003	0.003	3.133	0.0007	8.3
43	0.005	0.005	3.135	0.0012	13.7
61	0.007	0.007	3.137	0.0017	19.4
91	0.010	0.010	3.139	0.0025	29.0
164	0.015	0.015	3.143	0.0037	52.2
281	0.020	0.020	3.147	0.0050	89.3
398	0.025	0.025	3.151	0.0062	126.3
521	0.030	0.030	3.155	0.0075	165.1
641	0.035	0.035	3.159	0.0087	202.9
762	0.040	0.040	3.163	0.0100	240.9
858	0.045	0.045	3.167	0.0112	270.9
932	0.050	0.050	3.171	0.0125	293.9
954	0.055	0.055	3.175	0.0137	300.5
921	0.060	0.060	3.179	0.0150	289.7
863	0.065	0.065	3.183	0.0162	271.2
767	0.070	0.070	3.187	0.0175	240.7
678	0.075	0.075	3.191	0.0187	212.5

UNCONFINED COMPRESSION TESTING

Sample No. 3202-001 (28 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-002 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9544_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	16.9	**%**
BULK UNIT WEIGHT	133.7	**pcf**
DRY UNIT WEIGHT	114.4	**pcf**
UCS *	610.6	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-002 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9544_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	002	
2. WT MOISTURE TIN (tare weight)	1.00	g
3. WT WET SOIL + TARE	33.78	g
4. WT DRY SOIL + TARE	29.04	g
5. WT WATER, Ww	4.74	g
6. WT DRY SOIL, Ws	28.04	g
7. MOISTURE CONTENT, W	**16.90**	**%**

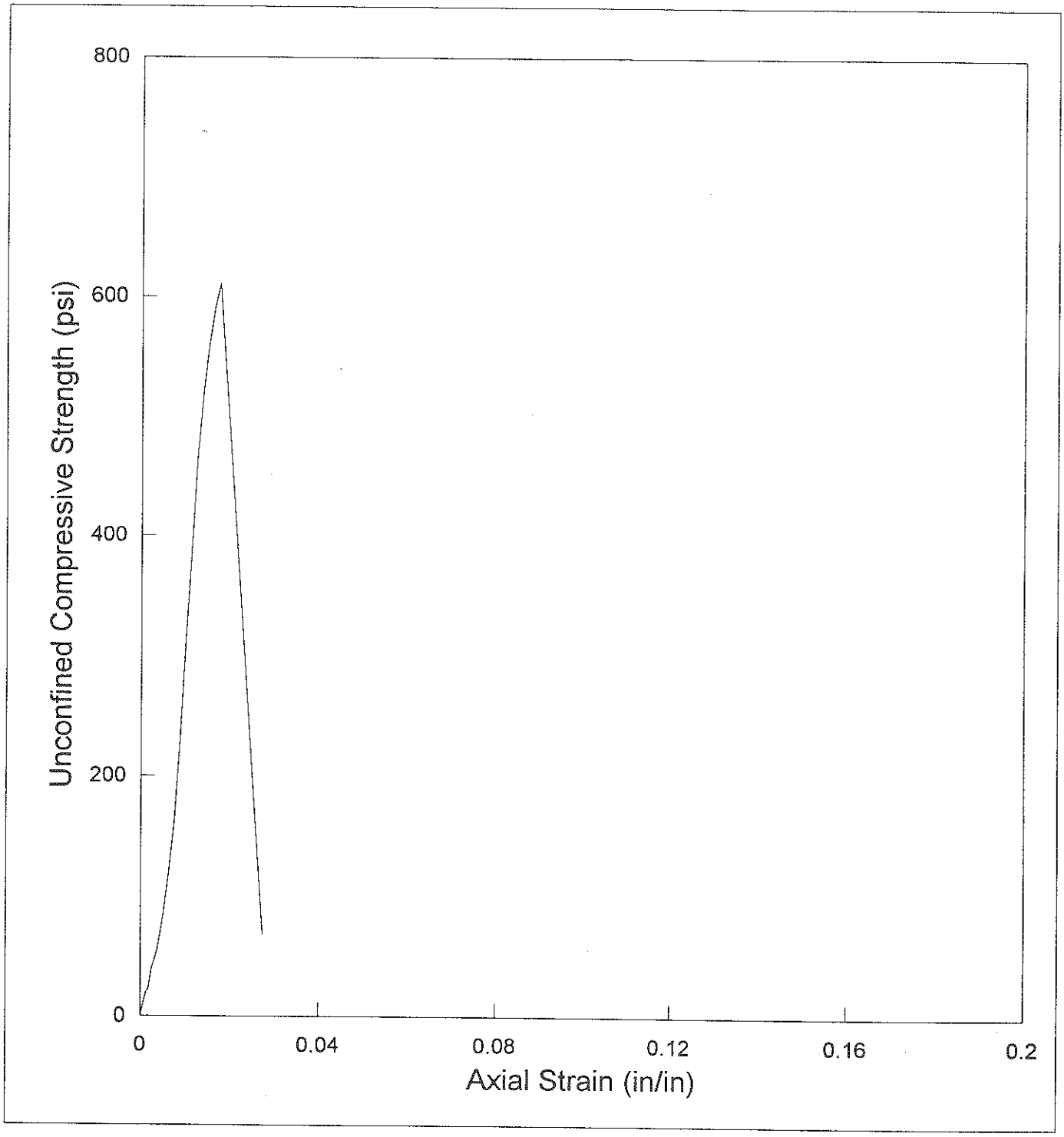
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.00 in.	4.00 in.
No. 2	2.00 in.	4.01 in.
No. 3	2.01 in.	4.01 in.
Average	**2.00 in.**	**4.01 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***443.38 g***
Initial Area, Ao	3.15 in^2
Initial Volume, Vo	12.63 in^3
Initial Bulk Unit Weight,	133.7 pcf
Initial Dry Unit Weight	114.4 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	610.6 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.152	0.0000	0.0
34	0.003	0.003	3.154	0.0007	10.8
61	0.005	0.005	3.156	0.0012	19.3
72	0.007	0.007	3.158	0.0017	22.8
124	0.010	0.010	3.160	0.0025	39.2
171	0.015	0.015	3.164	0.0037	54.0
254	0.020	0.020	3.168	0.0050	80.2
378	0.025	0.025	3.172	0.0062	119.2
514	0.030	0.030	3.176	0.0075	161.8
728	0.035	0.035	3.180	0.0087	228.9
998	0.040	0.040	3.184	0.0100	313.5
1232	0.045	0.045	3.188	0.0112	386.5
1490	0.050	0.050	3.192	0.0125	466.8
1672	0.055	0.055	3.196	0.0137	523.2
1798	0.060	0.060	3.200	0.0150	561.9
1893	0.065	0.065	3.204	0.0162	590.8
1959	0.070	0.070	3.208	0.0175	610.6
219	0.110	0.110	3.241	0.0275	67.6

UNCONFINED COMPRESSION TESTING

Sample No. 3202-002 (2 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-002 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9645_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	16.7	%
BULK UNIT WEIGHT	132.4	pcf
DRY UNIT WEIGHT	113.5	pcf
UCS *	1159.0	psi

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-002 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9645_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	002	
2. WT MOISTURE TIN (tare weight)	0.99	g
3. WT WET SOIL + TARE	27.82	g
4. WT DRY SOIL + TARE	23.98	g
5. WT WATER, Ww	3.84	g
6. WT DRY SOIL, Ws	22.99	g
7. MOISTURE CONTENT, W	**16.70**	**%**

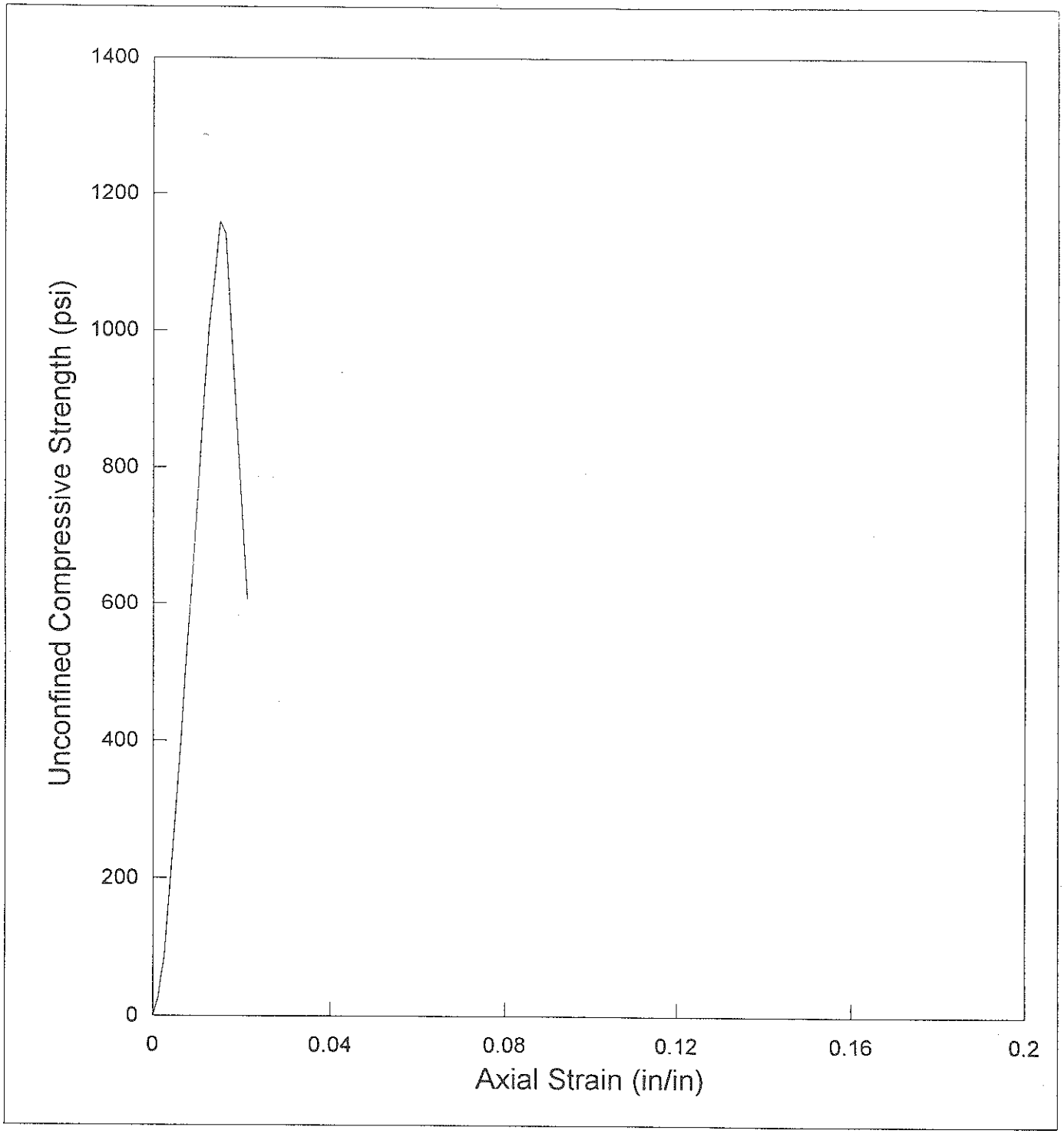
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	1.99 in.	4.00 in.
No. 2	2.01 in.	4.04 in.
No. 3	1.99 in.	3.98 in.
Average	**2.00 in.**	**4.01 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***436.03 g***
Initial Area, Ao	3.13 in^2
Initial Volume, Vo	12.55 in^3
Initial Bulk Unit Weight,	132.4 pcf
Initial Dry Unit Weight	113.5 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	1159.0 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.131	0.0000	0.0
48	0.003	0.003	3.133	0.0007	15.3
86	0.005	0.005	3.135	0.0012	27.4
165	0.007	0.007	3.137	0.0017	52.6
259	0.010	0.010	3.139	0.0025	82.5
585	0.015	0.015	3.143	0.0037	186.1
904	0.020	0.020	3.147	0.0050	287.3
1255	0.025	0.025	3.151	0.0062	398.3
1661	0.030	0.030	3.155	0.0075	526.5
2011	0.035	0.035	3.159	0.0087	636.6
2393	0.040	0.040	3.163	0.0100	756.6
2814	0.045	0.045	3.167	0.0112	888.6
3184	0.050	0.050	3.171	0.0125	1004.2
3421	0.055	0.055	3.175	0.0137	1077.6
3684	0.060	0.060	3.179	0.0150	1159.0
3631	0.065	0.065	3.183	0.0162	1140.8
3208	0.070	0.070	3.187	0.0175	1006.7
1939	0.085	0.085	3.199	0.0212	606.1

UNCONFINED COMPRESSION TESTING

Sample No. 3202-002 (28 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-003 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9545_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	17.5	**%**
BULK UNIT WEIGHT	131.0	**pcf**
DRY UNIT WEIGHT	111.4	**pcf**
UCS *	1048.8	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-003 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9545_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	003	
2. WT MOISTURE TIN (tare weight)	0.98	g
3. WT WET SOIL + TARE	22.29	g
4. WT DRY SOIL + TARE	19.11	g
5. WT WATER, Ww	3.18	g
6. WT DRY SOIL, Ws	18.13	g
7. MOISTURE CONTENT, W	**17.54**	**%**

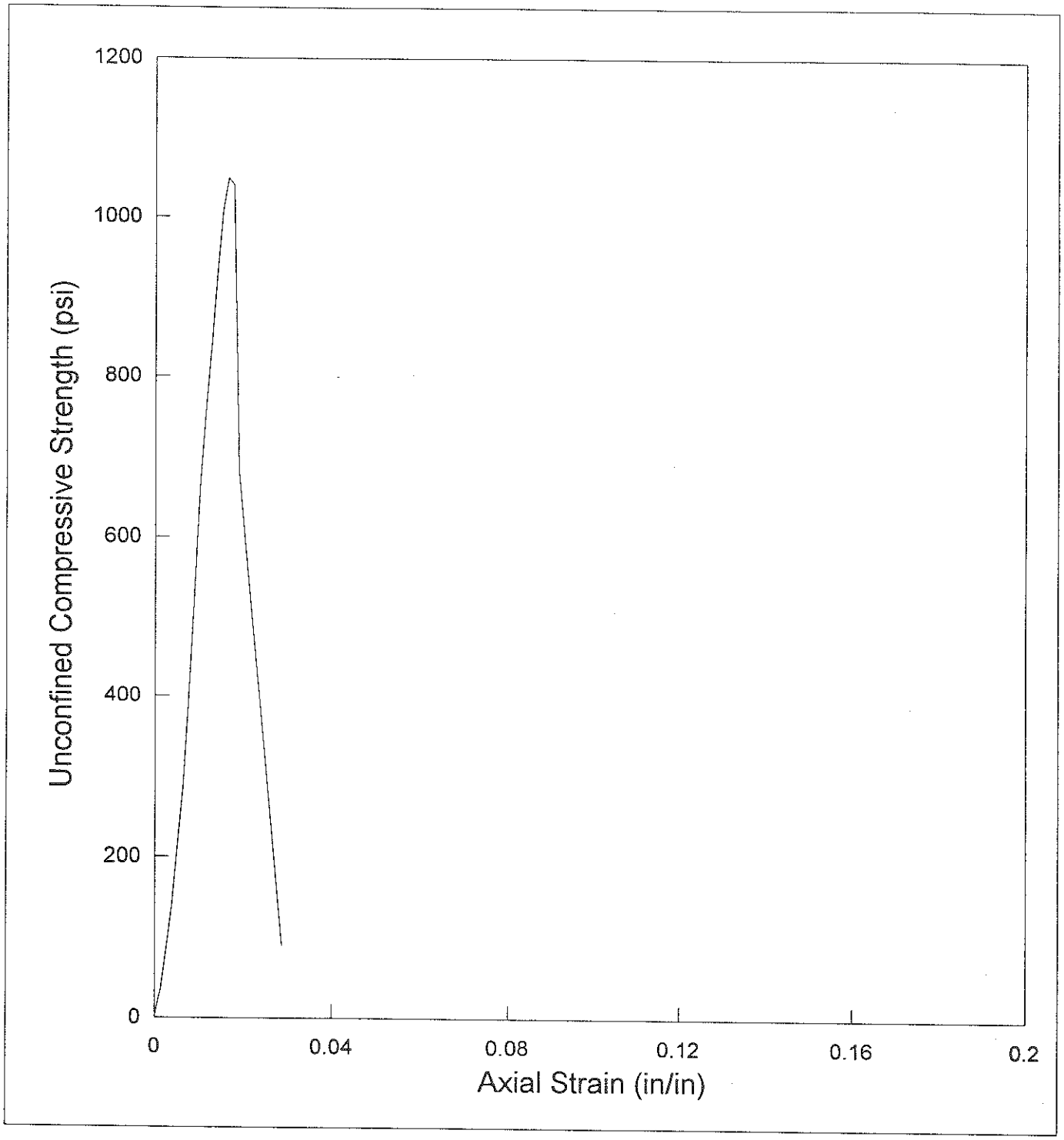
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.00 in.	4.00 in.
No. 2	2.00 in.	4.01 in.
No. 3	1.99 in.	4.01 in.
Average	**2.00 in.**	**4.01 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***431.37 g***
Initial Area, Ao	3.13 in^2
Initial Volume, Vo	12.55 in^3
Initial Bulk Unit Weight,	131.0 pcf
Initial Dry Unit Weight	111.4 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	1048.8 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.131	0.0000	0.0
63	0.003	0.003	3.133	0.0007	20.1
99	0.005	0.005	3.135	0.0012	31.6
159	0.007	0.007	3.137	0.0017	50.7
266	0.010	0.010	3.139	0.0025	84.7
433	0.015	0.015	3.143	0.0037	137.8
661	0.020	0.020	3.147	0.0050	210.1
899	0.025	0.025	3.151	0.0062	285.3
1259	0.030	0.030	3.155	0.0075	399.1
1671	0.035	0.035	3.159	0.0087	529.0
2120	0.040	0.040	3.163	0.0100	670.3
2412	0.045	0.045	3.167	0.0112	761.7
2675	0.050	0.050	3.171	0.0125	843.7
2959	0.055	0.055	3.175	0.0137	932.1
3207	0.060	0.060	3.179	0.0150	1008.9
3338	0.065	0.065	3.183	0.0162	1048.8
3315	0.070	0.070	3.187	0.0175	1040.2
2177	0.075	0.075	3.191	0.0187	682.3
288	0.115	0.115	3.224	0.0287	89.3

UNCONFINED COMPRESSION TESTING

Sample No. 3202-003 (2 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-003 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9646_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	16.7	%
BULK UNIT WEIGHT	129.1	pcf
DRY UNIT WEIGHT	110.6	pcf
UCS *	1502.2	psi

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-003 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9646_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	003	
2. WT MOISTURE TIN (tare weight)	0.98	g
3. WT WET SOIL + TARE	39.54	g
4. WT DRY SOIL + TARE	34.01	g
5. WT WATER, Ww	5.53	g
6. WT DRY SOIL, Ws	33.03	g
7. MOISTURE CONTENT, W	**16.74**	**%**

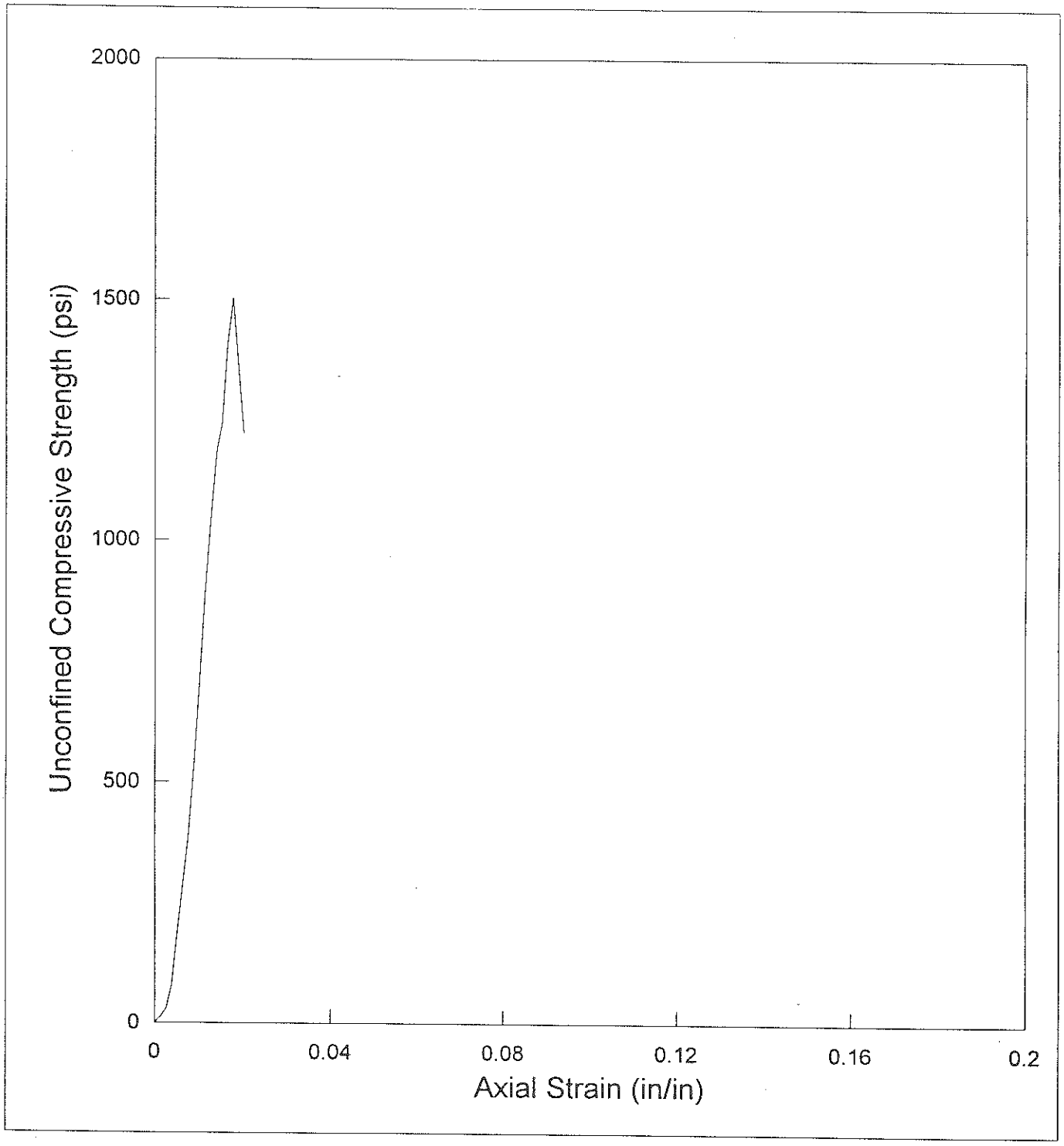
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.00 in.	3.98 in.
No. 2	2.00 in.	3.97 in.
No. 3	2.03 in.	3.98 in.
Average	**2.01 in.**	**3.98 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***427.70 g***
Initial Area, Ao	3.17 in^2
Initial Volume, Vo	12.62 in^3
Initial Bulk Unit Weight,	129.1 pcf
Initial Dry Unit Weight	110.6 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	1502.2 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.173	0.0000	0.0
25	0.003	0.003	3.175	0.0008	7.9
38	0.005	0.005	3.177	0.0013	12.0
61	0.007	0.007	3.179	0.0018	19.2
94	0.010	0.010	3.181	0.0025	29.5
248	0.015	0.015	3.185	0.0038	77.9
597	0.020	0.020	3.189	0.0050	187.2
916	0.025	0.025	3.193	0.0063	286.9
1226	0.030	0.030	3.197	0.0075	383.5
1738	0.035	0.035	3.201	0.0088	542.9
2238	0.040	0.040	3.205	0.0101	698.2
2851	0.045	0.045	3.209	0.0113	888.3
3376	0.050	0.050	3.213	0.0126	1050.6
3807	0.055	0.055	3.218	0.0138	1183.2
4004	0.060	0.060	3.222	0.0151	1242.8
4542	0.065	0.065	3.226	0.0163	1408.0
4852	0.070	0.070	3.230	0.0176	1502.2
3954	0.080	0.080	3.238	0.0201	1221.0

UNCONFINED COMPRESSION TESTING

Sample No. 3202-003 (28 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-004 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9546_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	17.3	**%**
BULK UNIT WEIGHT	127.9	**pcf**
DRY UNIT WEIGHT	109.1	**pcf**
UCS *	239.9	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-004 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9546_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	004	
2. WT MOISTURE TIN (tare weight)	0.98	g
3. WT WET SOIL + TARE	24.64	g
4. WT DRY SOIL + TARE	21.15	g
5. WT WATER, Ww	3.49	g
6. WT DRY SOIL, Ws	20.17	g
7. MOISTURE CONTENT, W	**17.30**	**%**

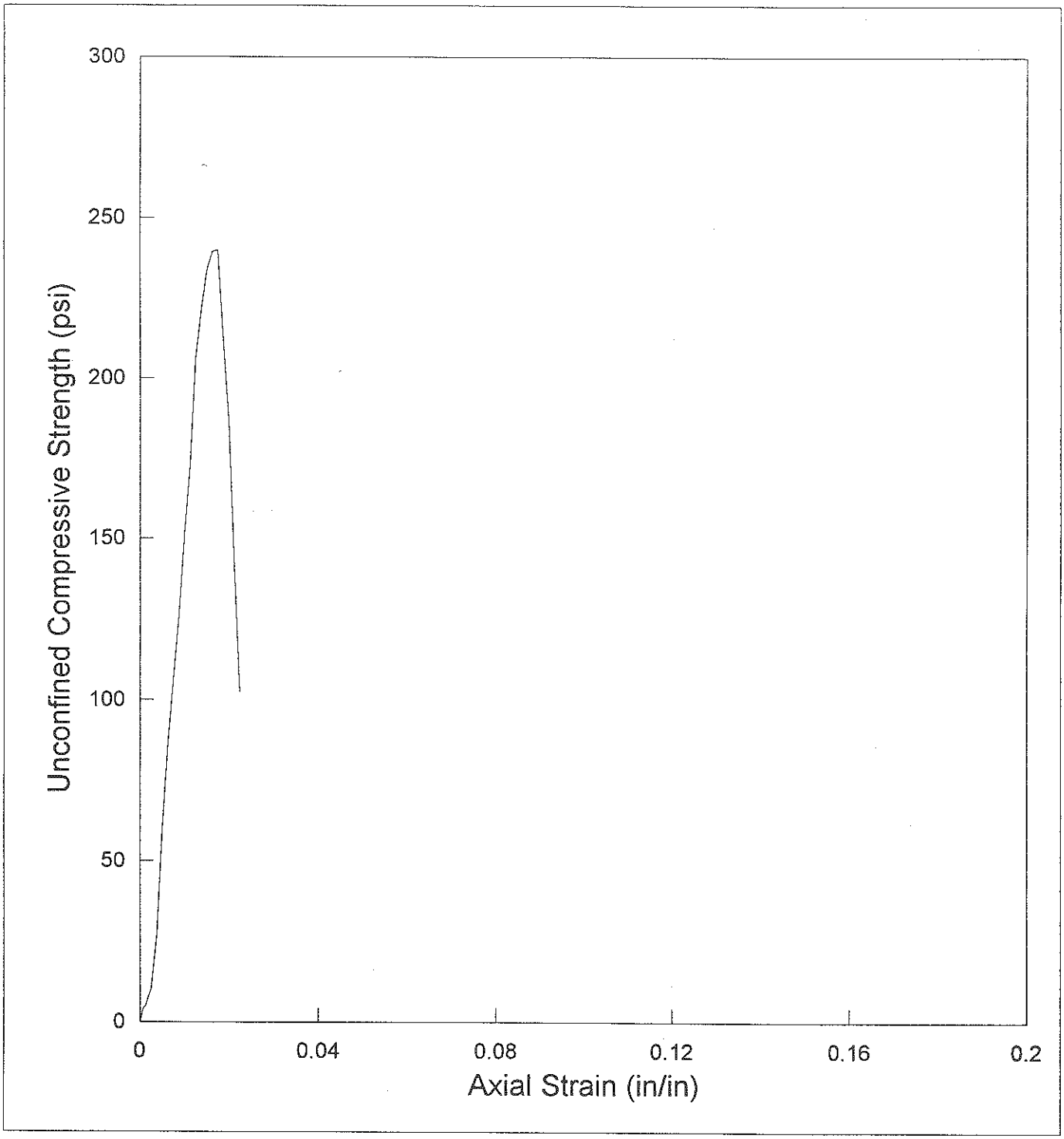
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	1.99 in.	4.03 in.
No. 2	2.00 in.	4.04 in.
No. 3	2.01 in.	4.04 in.
Average	**2.00 in.**	**4.04 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***425.91 g***
Initial Area, Ao	3.14 in^2
Initial Volume, Vo	12.68 in^3
Initial Bulk Unit Weight,	127.9 pcf
Initial Dry Unit Weight	109.1 pcf
15 % Strain (0.15 Lo)	0.61 in.
UCS	239.9 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.142	0.0000	0.0
13	0.003	0.003	3.144	0.0007	4.1
15	0.005	0.005	3.145	0.0012	4.8
22	0.007	0.007	3.147	0.0017	7.0
32	0.010	0.010	3.149	0.0025	10.2
84	0.015	0.015	3.153	0.0037	26.6
190	0.020	0.020	3.157	0.0050	60.2
273	0.025	0.025	3.161	0.0062	86.4
336	0.030	0.030	3.165	0.0074	106.2
407	0.035	0.035	3.169	0.0087	128.4
480	0.040	0.040	3.173	0.0099	151.3
549	0.045	0.045	3.177	0.0111	172.8
655	0.050	0.050	3.181	0.0124	205.9
706	0.055	0.055	3.185	0.0136	221.7
746	0.060	0.060	3.189	0.0149	233.9
765	0.065	0.065	3.193	0.0161	239.6
767	0.070	0.070	3.197	0.0173	239.9
678	0.075	0.075	3.201	0.0186	211.8
599	0.080	0.080	3.205	0.0198	186.9
453	0.085	0.085	3.209	0.0211	141.2
329	0.090	0.090	3.213	0.0223	102.4

UNCONFINED COMPRESSION TESTING

Sample No. 3202-004 (2 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-004 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9647_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	16.2	%
BULK UNIT WEIGHT	127.1	pcf
DRY UNIT WEIGHT	109.4	pcf
UCS *	841.3	psi

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-004 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9647_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	004	
2. WT MOISTURE TIN (tare weight)	0.99	g
3. WT WET SOIL + TARE	29.58	g
4. WT DRY SOIL + TARE	25.59	g
5. WT WATER, Ww	3.99	g
6. WT DRY SOIL, Ws	24.60	g
7. MOISTURE CONTENT, W	**16.22**	**%**

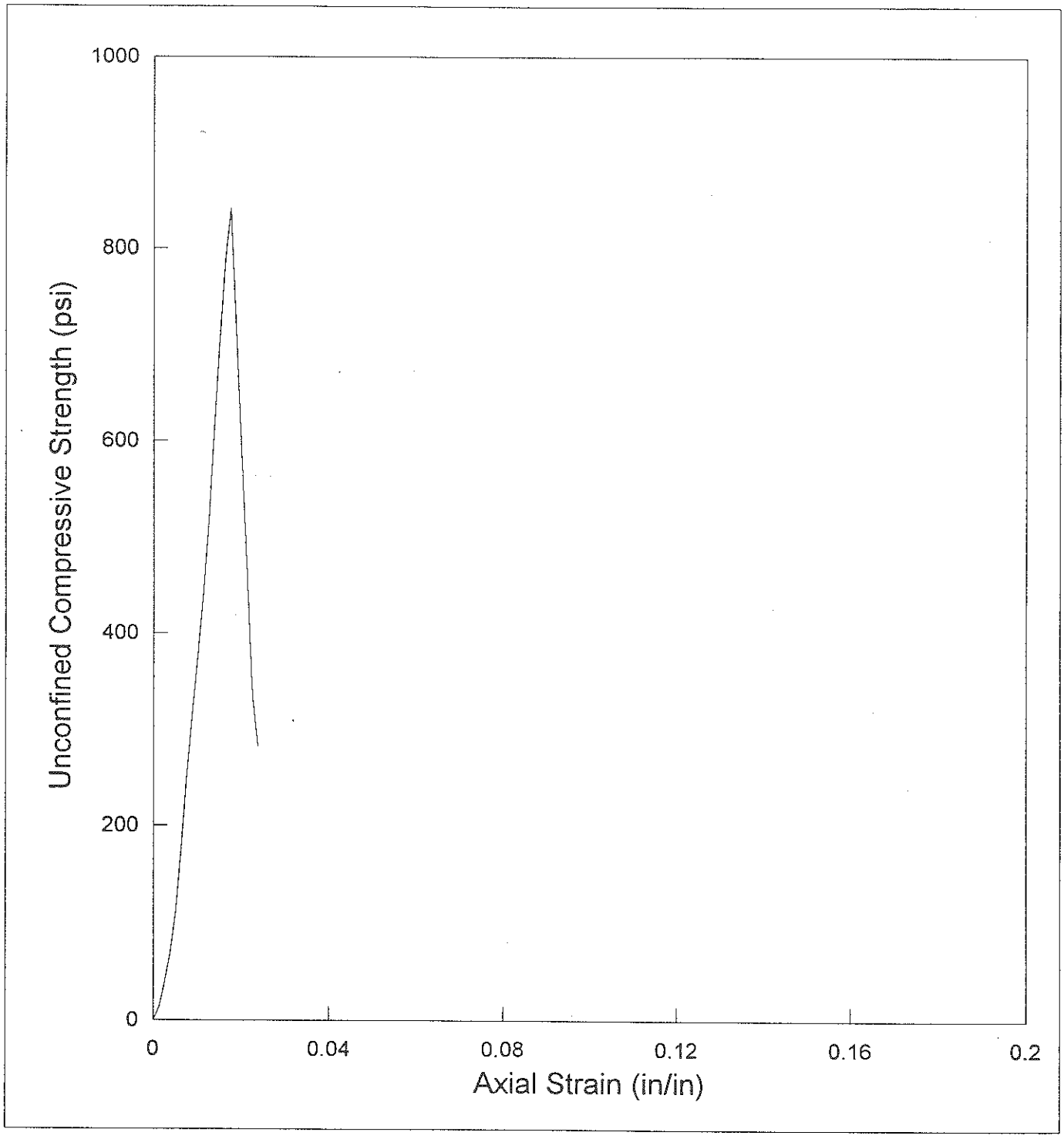
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.01 in.	4.01 in.
No. 2	2.01 in.	4.01 in.
No. 3	2.04 in.	4.00 in.
Average	**2.02 in.**	**4.01 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***428.56 g***
Initial Area, Ao	3.20 in^2
Initial Volume, Vo	12.84 in^3
Initial Bulk Unit Weight,	127.1 pcf
Initial Dry Unit Weight	109.4 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	841.3 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.205	0.0000	0.0
23	0.003	0.003	3.207	0.0007	7.2
41	0.005	0.005	3.209	0.0012	12.8
69	0.007	0.007	3.210	0.0017	21.5
124	0.010	0.010	3.213	0.0025	38.6
221	0.015	0.015	3.217	0.0037	68.7
357	0.020	0.020	3.221	0.0050	110.8
570	0.025	0.025	3.225	0.0062	176.8
821	0.030	0.030	3.229	0.0075	254.3
1026	0.035	0.035	3.233	0.0087	317.4
1218	0.040	0.040	3.237	0.0100	376.3
1429	0.045	0.045	3.241	0.0112	440.9
1679	0.050	0.050	3.245	0.0125	517.4
1994	0.055	0.055	3.249	0.0137	613.7
2299	0.060	0.060	3.253	0.0150	706.6
2567	0.065	0.065	3.258	0.0162	788.0
2744	0.070	0.070	3.262	0.0175	841.3
1101	0.090	0.090	3.278	0.0225	335.8
925	0.095	0.095	3.283	0.0237	281.8

UNCONFINED COMPRESSION TESTING

Sample No. 3202-004 (28 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-005 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9547_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	19.0	**%**
BULK UNIT WEIGHT	127.8	**pcf**
DRY UNIT WEIGHT	107.4	**pcf**
UCS *	420.2	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-005 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9547_US

MOISTURE CONTENT (Dry Basis)	
1. MOISTURE TIN NO.	005
2. WT MOISTURE TIN (tare weight)	1.00 g
3. WT WET SOIL + TARE	23.49 g
4. WT DRY SOIL + TARE	19.90 g
5. WT WATER, Ww	3.59 g
6. WT DRY SOIL, Ws	18.90 g
7. MOISTURE CONTENT, W	**18.99 %**

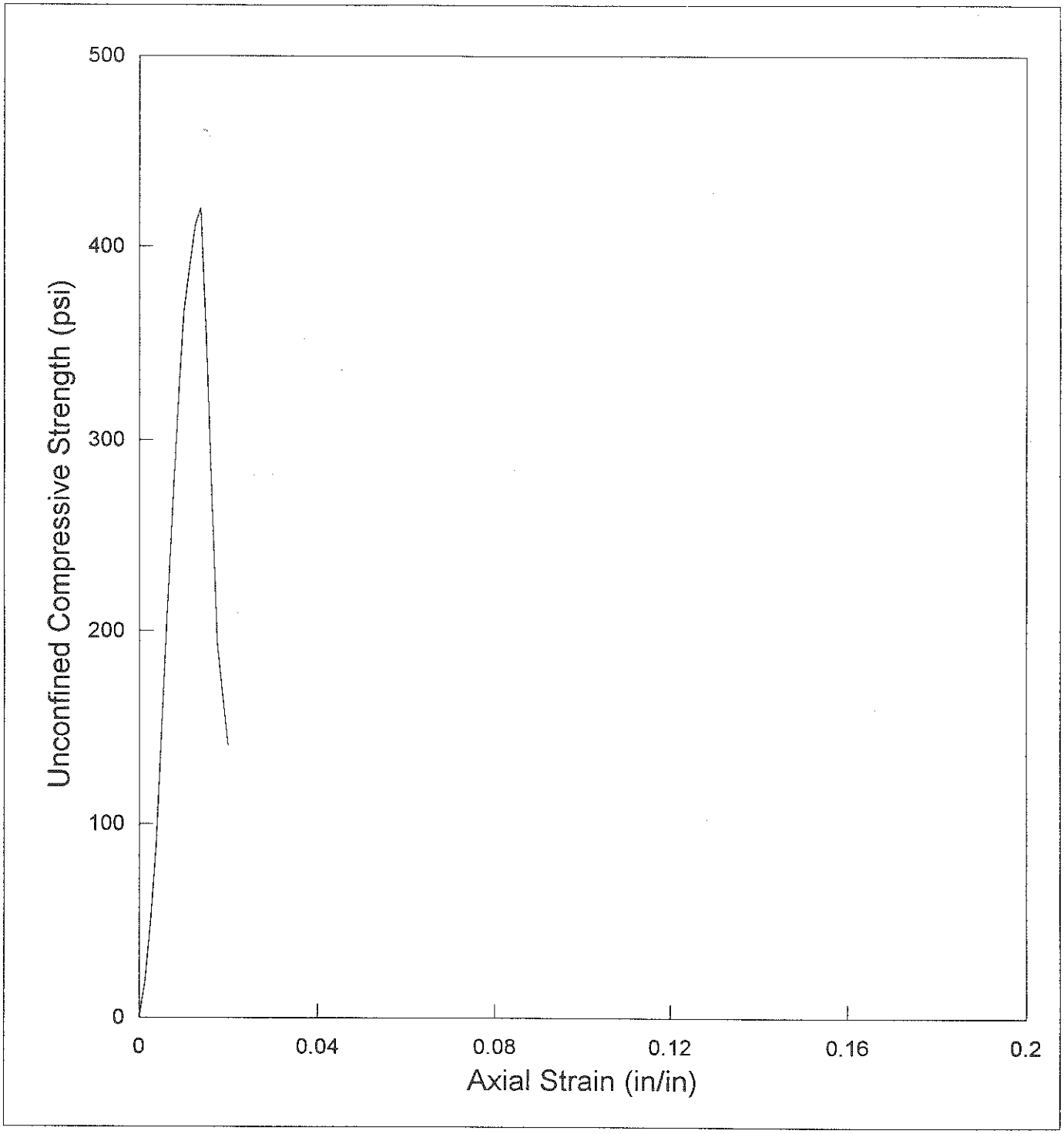
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.00 in.	4.03 in.
No. 2	2.01 in.	4.03 in.
No. 3	2.00 in.	4.02 in.
Average	**2.00 in.**	**4.03 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***425.85 g***
Initial Area, Ao	3.15 in^2
Initial Volume, Vo	12.69 in^3
Initial Bulk Unit Weight,	127.8 pcf
Initial Dry Unit Weight	107.4 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	420.2 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.152	0.0000	0.0
33	0.003	0.003	3.154	0.0007	10.5
56	0.005	0.005	3.156	0.0012	17.7
92	0.007	0.007	3.158	0.0017	29.1
154	0.010	0.010	3.160	0.0025	48.7
282	0.015	0.015	3.164	0.0037	89.1
481	0.020	0.020	3.168	0.0050	151.8
673	0.025	0.025	3.172	0.0062	212.2
863	0.030	0.030	3.176	0.0075	271.7
1037	0.035	0.035	3.180	0.0087	326.1
1167	0.040	0.040	3.184	0.0099	366.6
1245	0.045	0.045	3.188	0.0112	390.6
1313	0.050	0.050	3.192	0.0124	411.4
1343	0.055	0.055	3.196	0.0137	420.2
1128	0.060	0.060	3.200	0.0149	352.5
623	0.070	0.070	3.208	0.0174	194.2
451	0.080	0.080	3.216	0.0199	140.2

UNCONFINED COMPRESSION TESTING

Sample No. 3202-005 (2 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-005 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9648_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	17.1	%
BULK UNIT WEIGHT	127.4	pcf
DRY UNIT WEIGHT	108.8	pcf
UCS •	1252.3	psi

• UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-005 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9648_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	005	
2. WT MOISTURE TIN (tare weight)	0.99	g
3. WT WET SOIL + TARE	40.98	g
4. WT DRY SOIL + TARE	35.14	g
5. WT WATER, Ww	5.84	g
6. WT DRY SOIL, Ws	34.15	g
7. MOISTURE CONTENT, W	**17.10**	**%**

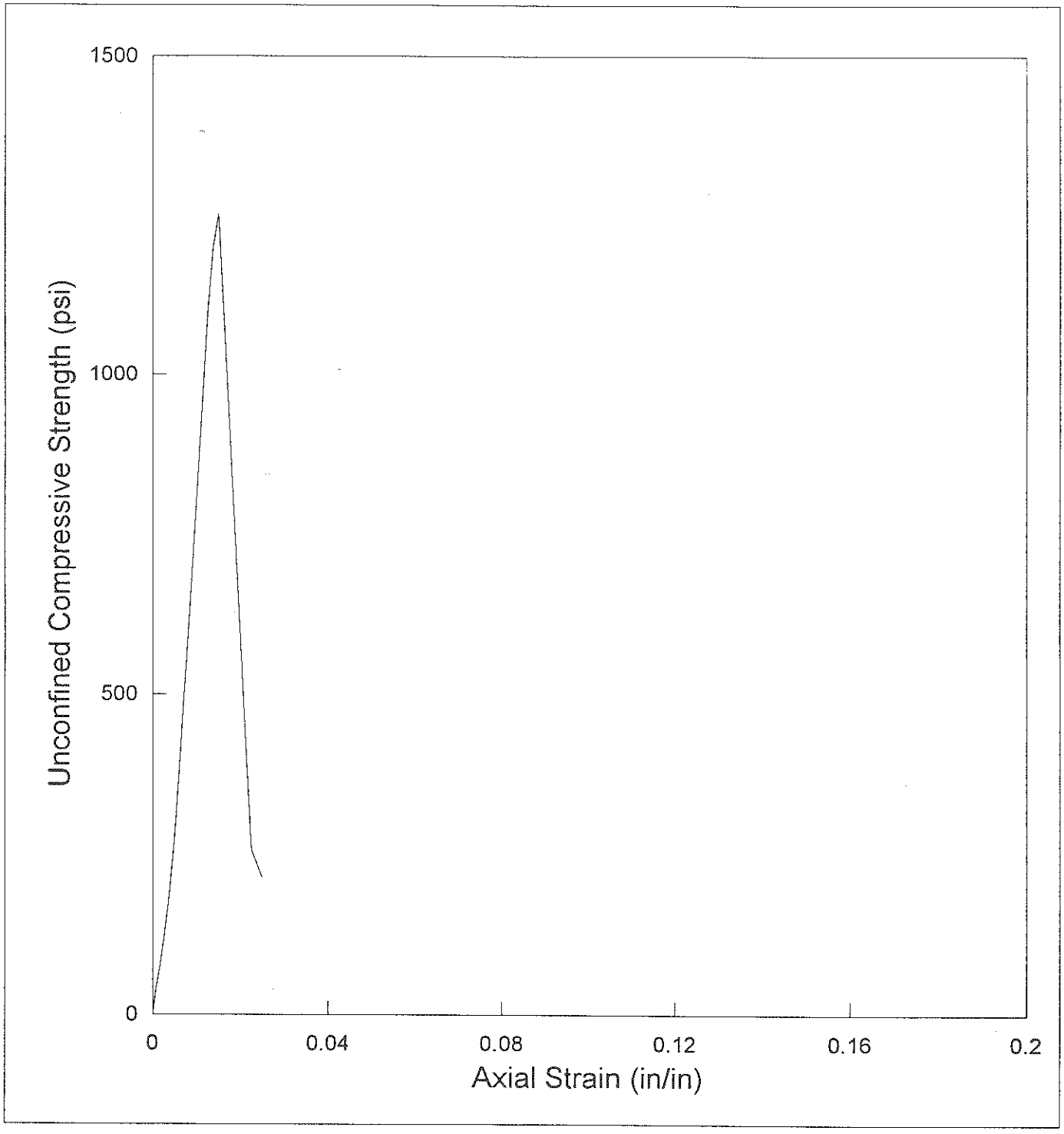
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.00 in.	4.00 in.
No. 2	2.00 in.	4.00 in.
No. 3	2.03 in.	4.02 in.
Average	**2.01 in.**	**4.01 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***425.18 g***
Initial Area, Ao	3.17 in^2
Initial Volume, Vo	12.71 in^3
Initial Bulk Unit Weight,	127.4 pcf
Initial Dry Unit Weight	108.8 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	1252.3 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.173	0.0000	0.0
124	0.003	0.003	3.175	0.0007	39.0
192	0.005	0.005	3.177	0.0012	60.4
249	0.007	0.007	3.179	0.0017	78.3
370	0.010	0.010	3.181	0.0025	116.3
597	0.015	0.015	3.185	0.0037	187.4
891	0.020	0.020	3.189	0.0050	279.4
1282	0.025	0.025	3.193	0.0062	401.5
1701	0.030	0.030	3.197	0.0075	532.1
2132	0.035	0.035	3.201	0.0087	666.0
2569	0.040	0.040	3.205	0.0100	801.5
3043	0.045	0.045	3.209	0.0112	948.2
3515	0.050	0.050	3.213	0.0125	1093.9
3860	0.055	0.055	3.217	0.0137	1199.8
4034	0.060	0.060	3.221	0.0150	1252.3
840	0.090	0.090	3.246	0.0225	258.8
694	0.100	0.100	3.254	0.0250	213.3

UNCONFINED COMPRESSION TESTING

Sample No. 3202-005 (28 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-006 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9548_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	20.7	**%**
BULK UNIT WEIGHT	132.8	**pcf**
DRY UNIT WEIGHT	110.0	**pcf**
UCS *	3.0	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-006 (2 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	25 OCTOBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	MC	TRACKING CODE:	9548_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	006	
2. WT MOISTURE TIN (tare weight)	0.99	g
3. WT WET SOIL + TARE	40.39	g
4. WT DRY SOIL + TARE	33.62	g
5. WT WATER, Ww	6.77	g
6. WT DRY SOIL, Ws	32.63	g
7. MOISTURE CONTENT, W	**20.75**	**%**

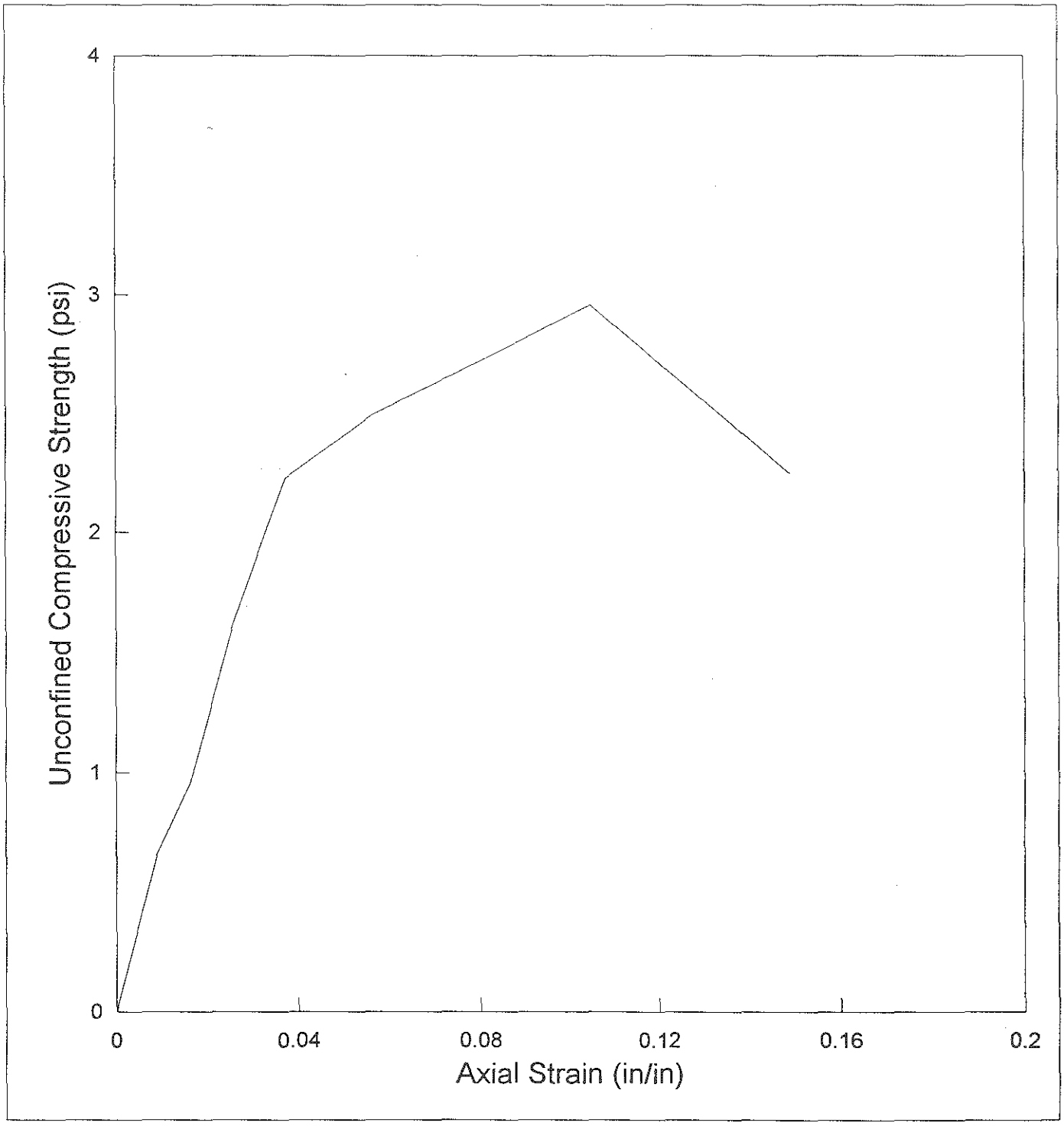
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	1.96 in.	3.91 in.
No. 2	1.96 in.	3.93 in.
No. 3	1.97 in.	3.92 in.
Average	**1.96 in.**	**3.92 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***413.67 g***
Initial Area, Ao	3.03 in^2
Initial Volume, Vo	11.87 in^3
Initial Bulk Unit Weight,	132.8 pcf
Initial Dry Unit Weight	110.0 pcf
15 % Strain (0.15 Lo)	0.59 in.
UCS	3.0 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.027	0.0000	0.0
2	0.035	0.035	3.055	0.0089	0.7
3	0.065	0.065	3.079	0.0166	1.0
5	0.100	0.100	3.107	0.0255	1.6
7	0.145	0.145	3.144	0.0370	2.2
8	0.220	0.220	3.207	0.0561	2.5
10	0.410	0.410	3.381	0.1046	3.0
8	0.585	0.585	3.559	0.1492	2.2

UNCONFINED COMPRESSION TESTING

Sample No. 3202-006 (2 DAY)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-006 (28 DAY)	DIAL GAGE:	LDT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9649_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	18.2	**%**
BULK UNIT WEIGHT	128.6	**pcf**
DRY UNIT WEIGHT	108.9	**pcf**
UCS *	507.8	**psi**

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	TECHALLOY	LOAD CELL:	6000 lb.
PROJECT No.:	3202	DATE CALIBRATED:	8 JUNE 1999
SAMPLE No.:	3202-006 (28 DAY)	DIAL GAGE:	LOT 2
TESTING DATE:	19 NOVEMBER 1999	LOADING RATE:	0.04 in./min.
TESTED BY:	GMZ	TRACKING CODE:	9649_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.	006	
2. WT MOISTURE TIN (tare weight)	0.98	g
3. WT WET SOIL + TARE	34.37	g
4. WT DRY SOIL + TARE	29.24	g
5. WT WATER, Ww	5.13	g
6. WT DRY SOIL, Ws	28.26	g
7. MOISTURE CONTENT, W	**18.15**	**%**

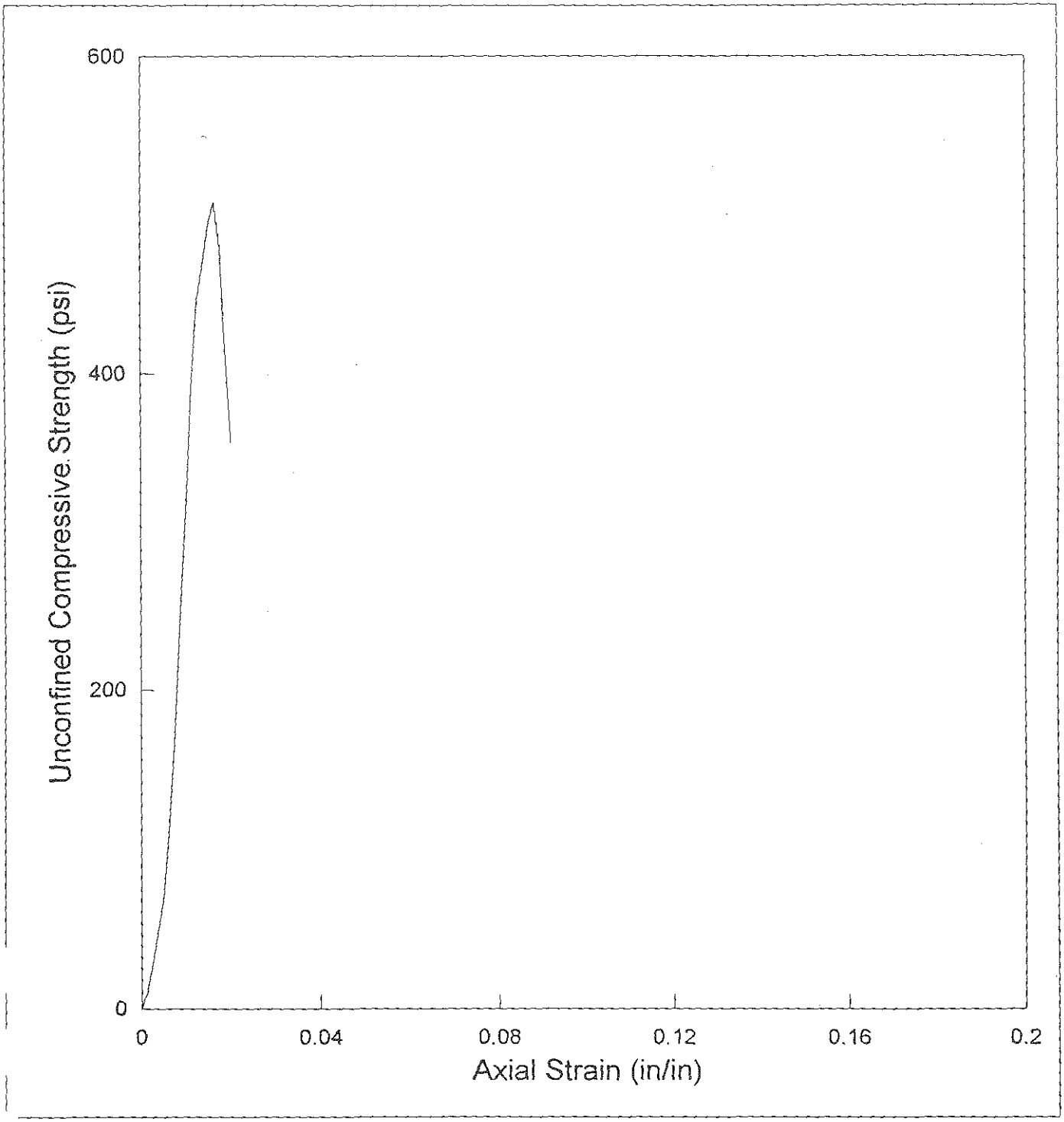
SOIL SPECIMEN DIMENSIONS		
	DIAMETER	*LENGTH*
No. 1	2.00 in.	3.99 in.
No. 2	2.01 in.	3.98 in.
No. 3	2.02 in.	4.01 in.
Average	**2.01 in.**	**3.99 in.**

SPECIMEN CONDITIONS	
Initial Specimen WT, Wo	***427.86 g***
Initial Area, Ao	3.17 in^2
Initial Volume, Vo	12.67 in^3
Initial Bulk Unit Weight,	128.6 pcf
Initial Dry Unit Weight	108.9 pcf
15 % Strain (0.15 Lo)	0.60 in.
UCS	507.8 psi

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in^2)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (psi)
0	0.000	0.000	3.173	0.0000	0.0
20	0.003	0.003	3.175	0.0008	6.3
31	0.005	0.005	3.177	0.0013	9.8
61	0.007	0.007	3.179	0.0018	19.2
87	0.010	0.010	3.181	0.0025	27.3
152	0.015	0.015	3.185	0.0038	47.7
226	0.020	0.020	3.189	0.0050	70.9
360	0.025	0.025	3.193	0.0063	112.7
534	0.030	0.030	3.197	0.0075	167.0
785	0.035	0.035	3.201	0.0088	245.2
1005	0.040	0.040	3.205	0.0100	313.6
1242	0.045	0.045	3.209	0.0113	387.0
1429	0.050	0.050	3.213	0.0125	444.7
1504	0.055	0.055	3.217	0.0138	467.5
1588	0.060	0.060	3.221	0.0150	492.9
1638	0.065	0.065	3.226	0.0163	507.8
1548	0.070	0.070	3.230	0.0175	479.3
1345	0.075	0.075	3.234	0.0188	415.9
1154	0.080	0.080	3.238	0.0200	356.4

UNCONFINED COMPRESSION TESTING

Sample No. 3202-006 (28 DAY)



PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	127.9 pcf	130.5 pcf
DRY UNIT WEIGHT	114.3 pcf	112.3 pcf
MOISTURE CONTENT	11.9 %	16.2 %
PERMEABILITY @ 20°C	2.5E-07 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	001	001
2. WT MOISTURE TIN (tare weight)	0.00 g	236.16 g
3. WT WET SOIL + TARE	513.37 g	768.90 g
4. WT DRY SOIL + TARE	458.64 g	694.80 g
5. WT WATER, Ww	54.73 g	74.10 g
6. WT DRY SOIL, Ws	458.64 g	458.64 g
7. MOISTURE CONTENT, W	11.93 %	16.16 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.97 in.*	*2.97 in.*	*2.20 in.*	*2.20 in.*
No. 2	*2.97 in.*	*2.97 in.*	*2.21 in.*	*2.25 in.*
No. 3	*2.97 in.*	*2.98 in.*	*2.21 in.*	*2.27 in.*
Average	2.97 in.	2.97 in.	2.21 in.	2.24 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*513.37 g*	*532.74 g*
Area, Ao	6.93 in^2	6.94 in^2
Volume, Vo	15.29 in^3	15.55 in^3
Bulk Unit Weight	127.9 pcf	130.5 pcf
Dry Unit Weight	114.3 pcf	112.3 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
11/24/99	9 : 38	RKS	7.0	5.0	5.3				
11/24/99	9 : 53	RKS	17.0	15.0	15.3	12.8	10.0	7.5	0.75
11/24/99	10 : 20	GMZ	27.0	25.0	25.4	22.7	10.0	7.4	0.74
11/24/99	10 : 42	RKS	37.0	35.0	35.3	33.3	10.0	7.9	0.79
11/24/99	11 : 40	RKS	47.0	45.0	45.5	44.3	10.0	9.0	0.90
11/24/99	13 : 50	RKS	57.0	55.0	55.8	54.3	10.0	8.8	0.88
11/24/99	14 : 49	GMZ	67.0	65.0	65.6	65.0	10.0	9.2	0.92
11/24/99	15 : 45	RKS	77.0	75.0	*	75.2	10.0	9.6	0.96
11/24/99	15 : 45	RKS	67.0	65.0	*	*	*	*	*

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		

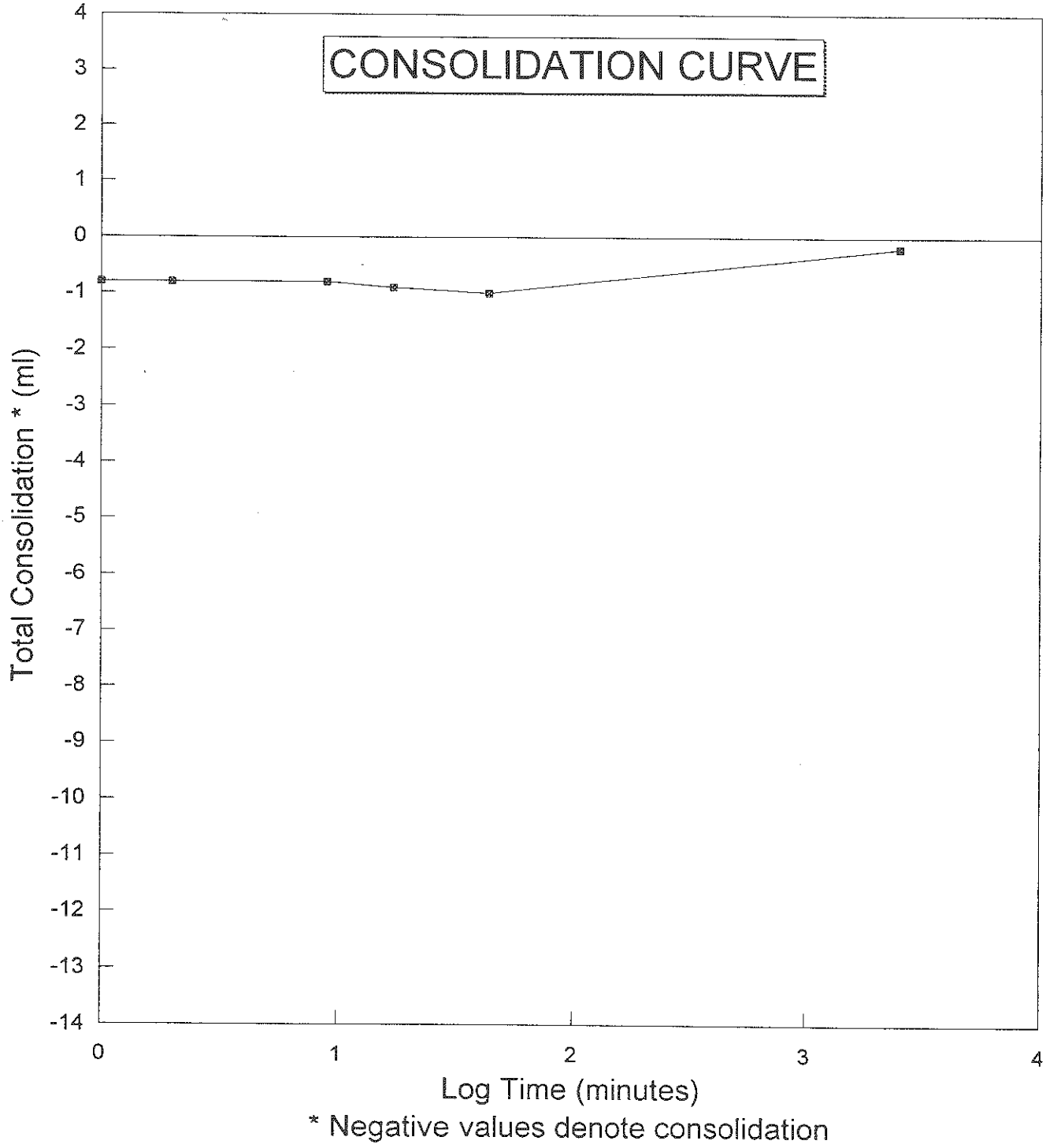
CELL PRESSURE: 75 psi BACK PRESSURE: 65 psi EFFECTIVE STRESS: 10 psi

TEST DATE	TESTED BY	TIME (Military)	ELAPSED TIME (minutes)	TOTAL TIME (minutes)	TOTAL TIME (Log)	SPECIMEN CONSOLIDATION (ml)				
						READING			ACTUAL	
						CELL	BOTTOM	TOP	CELL (Cc)	TOTAL (Ct)
11 /24 /99	RKS	15 : 50				0.0	24.0	24.0	0.0	0.0
11 /24 /99	RKS	15 : 51	1	1	0.00	0.8	23.7	23.5	0.8	0.8
11 /24 /99	RKS	15 : 52	1	2	0.30	0.9	23.7	23.5	0.9	0.8
11 /24 /99	RKS	15 : 59	7	9	0.95	1.0	23.7	23.5	1.0	0.8
11 /24 /99	RKS	16 : 7	8	17	1.23	1.2	23.6	23.5	1.2	0.9
11 /24 /99	RKS	16 : 33	26	43	1.63	1.6	23.6	23.4	1.6	1.0
11 /26 /99	RKS	9 : 22	2449	2492	3.40	21.7	23.9	23.9	21.7	0.2

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		



* Negative values denote consolidation

PERMEABILITY

TEST DATA

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		

DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	HYDRAULIC HEAD (cm)		TEMP. C°	GAUGE PRESSURE (psi)		
				INFLUENT	EFFLUENT		CELL	INFLUENT	EFFLUENT
11 /26 /99	RKS	9 : 27		0.0	24.0	20.0	75.0	65.0	65.0
11 /26 /99	RKS	12 : 37	190	0.7	23.3	20.0	75.0	65.0	65.0
11 /27 /99	CG	18 : 5	1768	4.9	19.3	20.0	75.0	65.0	65.0
11 /28 /99	CG	12 : 24	1099	6.5	17.8	20.5	75.0	65.0	65.0
11 /29 /99	RKS	7 : 49	1165	7.6	16.7	20.0	75.0	65.0	65.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9661
SAMPLE No.:	3202-001	EQUIPMENT No.:	1
TEST DATE:	23 November 1999		

ELAPSED TIME (minutes)	*HYDRAULIC HEAD DIFFERENCE (cm)*		*EFFLUENT - INFLUENT RATIO*	*HYDRAULIC GRADIENT (cm/cm)*	*HYDRAULIC CONDUCTIVITY (cm/sec)*	
	INFLUENT	*EFFLUENT*			*@ Temp.*	*@ 20° C*
RESET				4.282		
190	0.7	0.7	1.00	4.032	3.31E-07	3.30E-07
1768	4.2	4.0	0.95	2.569	2.66E-07	2.66E-07
1099	1.6	1.5	0.94	2.016	2.31E-07	2.28E-07
1165	1.1	1.1	1.00	1.624	1.94E-07	1.94E-07

PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		

Due to speed of permeability, only two readings were recorded within the allowable limits, therefore, the permeability should be viewed as an approximation.

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	132.5 pcf	132.7 pcf
DRY UNIT WEIGHT	116.8 pcf	112.7 pcf
MOISTURE CONTENT	13.4 %	17.8 %
PERMEABILITY @ 20°C	8.6E-09 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	002	002
2. WT MOISTURE TIN (tare weight)	0.00 g	407.54 g
3. WT WET SOIL + TARE	636.80 g	1069.10 g
4. WT DRY SOIL + TARE	561.46 g	969.00 g
5. WT WATER, Ww	75.34 g	100.10 g
6. WT DRY SOIL, Ws	561.46 g	561.46 g
7. MOISTURE CONTENT, W	13.42 %	17.83 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.93 in.*	*2.96 in.*	*2.70 in.*	*2.72 in.*
No. 2	*2.94 in.*	*2.97 in.*	*2.71 in.*	*2.73 in.*
No. 3	*2.93 in.*	*2.97 in.*	*2.72 in.*	*2.79 in.*
Average	2.93 in.	2.97 in.	2.71 in.	2.75 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*636.80 g*	*661.56 g*
Area, Ao	6.76 in^2	6.91 in^2
Volume, Vo	18.31 in^3	18.99 in^3
Bulk Unit Weight	132.5 pcf	132.7 pcf
Dry Unit Weight	116.8 pcf	112.7 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
11/29/99	9 : 8	RKS	7.0	5.0	5.4				
11/29/99	9 : 28	RKS	17.0	15.0	15.5	9.9	10.0	4.5	0.45
11/29/99	9 : 51	RKS	27.0	25.0	25.4	22.3	10.0	6.8	0.68
11/29/99	10 : 20	RKS	37.0	35.0	35.4	33.7	10.0	8.3	0.83
11/29/99	10 : 50	RKS	47.0	45.0	45.5	44.3	10.0	8.9	0.89
11/29/99	12 : 1	RKS	57.0	55.0	*	55.0	10.0	9.5	0.95

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		

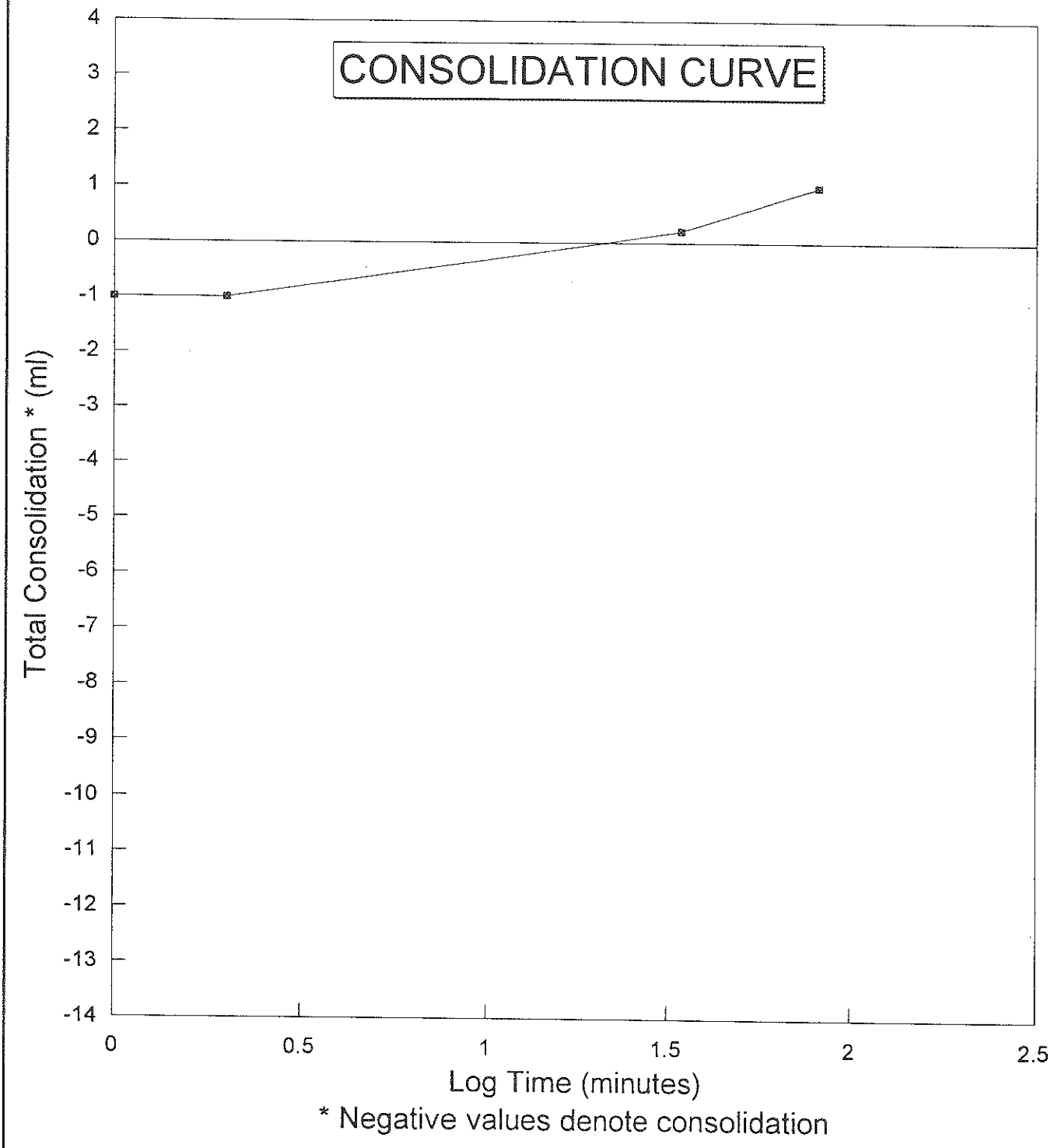
CELL PRESSURE: 65 psi BACK PRESSURE: 55 psi EFFECTIVE STRESS: 10 psi

TEST DATE	TESTED BY	TIME (Military)	ELAPSED TIME (minutes)	TOTAL TIME (minutes)	TOTAL TIME (Log)	SPECIMEN CONSOLIDATION (ml)				
						READING			ACTUAL	
						CELL	BOTTOM	TOP	CELL (Cc)	TOTAL (Ct)
11 /29 /99	RKS	12 : 4				0.0	25.0	25.0	0.0	0.0
11 /29 /99	RKS	12 : 5	1	1	0.00	0.8	24.5	24.5	0.8	1.0
11 /29 /99	RKS	12 : 6	1	2	0.30	0.8	24.5	24.5	0.8	1.0
11 /29 /99	RKS	12 : 38	32	34	1.53	1.2	25.0	25.2	1.2	-0.2
11 /29 /99	RKS	13 : 25	47	81	1.91	1.5	25.5	25.5	1.5	-1.0

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		



* Negative values denote consolidation

PERMEABILITY

TEST DATA

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		

				HYDRAULIC HEAD (cm)			GAUGE PRESSURE (psi)		
DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	INFLUENT	EFFLUENT	TEMP. C°	CELL	INFLUENT	EFFLUENT
11 /30 /99	RKS	9 : 34		0.0	25.0	16.5	65.0	58.0	52.0
11 /30 /99	RKS	14 : 48	314	0.7	24.6	19.5	65.0	58.0	52.0
12 / 1 /99	CG	7 : 18	990	2.0	23.6	16.0	65.0	58.0	52.0
12 / 1 /99	CG	10 : 38	200	2.3	23.3	16.5	65.0	58.0	52.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9744_PM
SAMPLE No.:	3202-002 (28 DAY)	EQUIPMENT No.:	5
TEST DATE:	29 November 1999		

ELAPSED TIME (minutes)	*HYDRAULIC HEAD DIFFERENCE (cm)*		*EFFLUENT - INFLUENT RATIO*	*HYDRAULIC GRADIENT (cm/cm)*	*HYDRAULIC CONDUCTIVITY (cm/sec)*	
	INFLUENT	*EFFLUENT*			*@ Temp.*	*@ 20° C*
RESET				64.945		
314	0.7	0.4	0.57	64.785	1.03E-08	1.04E-08
990	1.3	1.0	0.77	64.451	6.87E-09	7.54E-09
200	0.3	0.3	1.00	64.364	8.90E-09	9.66E-09

PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		

Due to the impermeability of the sample no readings were recorded during testing.

No movement was observed even with an increase in the hydraulic gradient.

Kiber approximates the hydraulic conductivity of the sample to be less than 1.0E-9.

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	131.8 pcf	130.5 pcf
DRY UNIT WEIGHT	114.5 pcf	109.6 pcf
MOISTURE CONTENT	15.1 %	19.1 %
PERMEABILITY @ 20°C	< 1.0E-9 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	003	003
2. WT MOISTURE TIN (tare weight)	0.00 g	194.72 g
3. WT WET SOIL + TARE	634.70 g	851.60 g
4. WT DRY SOIL + TARE	551.58 g	746.30 g
5. WT WATER, Ww	83.12 g	105.30 g
6. WT DRY SOIL, Ws	551.58 g	551.58 g
7. MOISTURE CONTENT, W	15.07 %	19.09 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.92 in.*	*2.96 in.*	*2.72 in.*	*2.77 in.*
No. 2	*2.92 in.*	*2.97 in.*	*2.73 in.*	*2.75 in.*
No. 3	*2.93 in.*	*2.97 in.*	*2.75 in.*	*2.80 in.*
Average	2.92 in.	2.97 in.	2.73 in.	2.77 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*634.70 g*	*656.88 g*
Area, Ao	6.71 in^2	6.91 in^2
Volume, Vo	18.35 in^3	19.17 in^3
Bulk Unit Weight	131.8 pcf	130.5 pcf
Dry Unit Weight	114.5 pcf	109.6 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
11/29/99	8 : 52	RKS	7.0	5.0	5.3				
11/29/99	9 : 0	RKS	17.0	15.0	15.5	9.1	10.0	3.8	0.38
11/29/99	9 : 27	RKS	27.0	25.0	25.5	21.7	10.0	6.2	0.62
11/29/99	9 : 50	RKS	37.0	35.0	35.5	33.3	10.0	7.8	0.78
11/29/99	10 : 20	RKS	47.0	45.0	45.6	44.3	10.0	8.8	0.88
11/29/99	11 : 4	RKS	57.0	55.0	55.6	55.0	10.0	9.4	0.94
11/29/99	11 : 55	RKS	67.0	65.0	*	65.1	10.0	9.5	0.95
11/29/99	11 : 55	RKS	57.0	55.0	*	*	*	*	*

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		

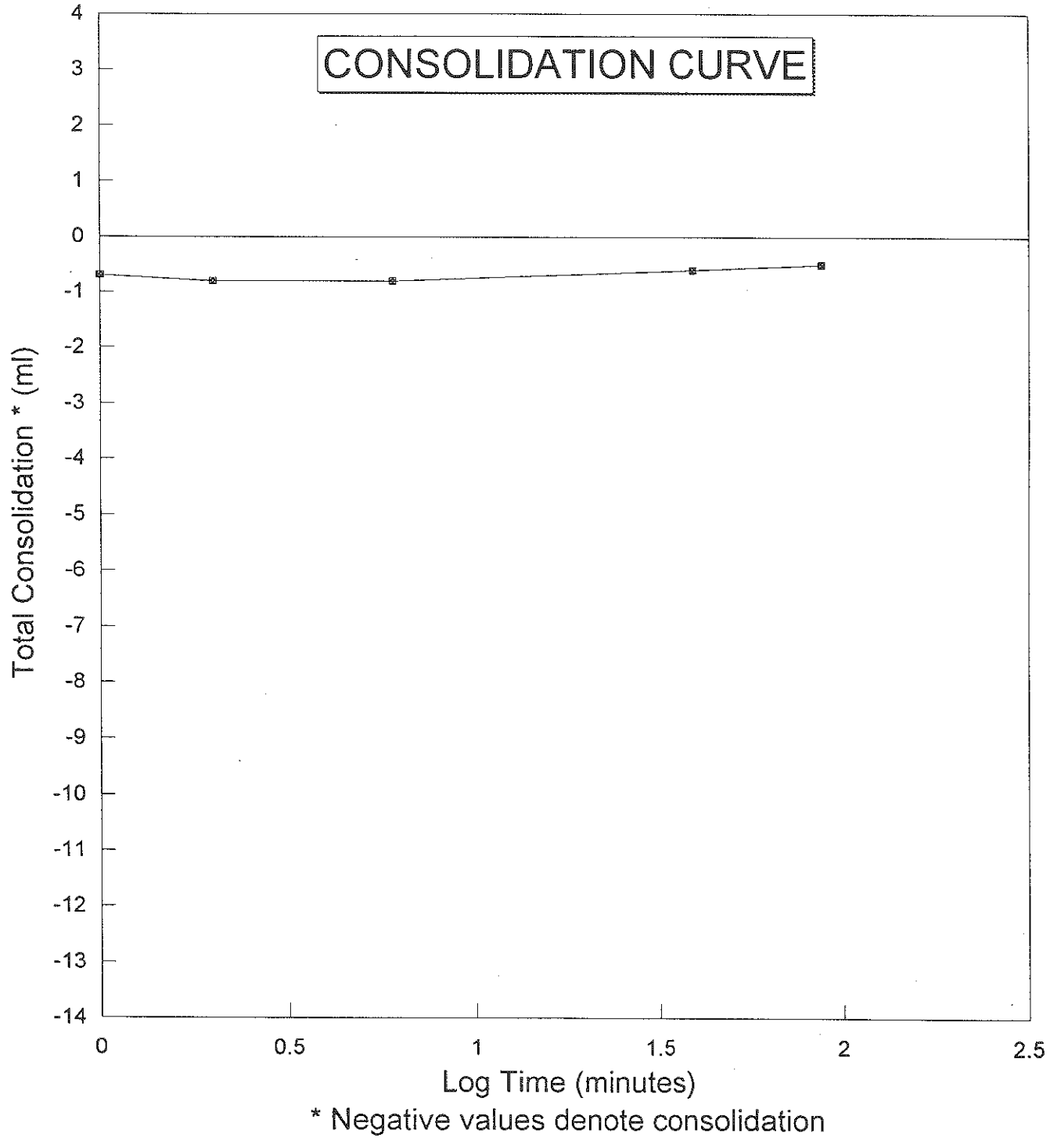
CELL PRESSURE: 65 psi BACK PRESSURE: 55 psi EFFECTIVE STRESS: 10 psi

TEST DATE	TESTED BY	TIME (Military)	ELAPSED TIME (minutes)	TOTAL TIME (minutes)	TOTAL TIME (Log)	SPECIMEN CONSOLIDATION (ml)				
						READING			ACTUAL	
						CELL	BOTTOM	TOP	CELL (Cc)	TOTAL (Ct)
11 /29 /99	RKS	11 : 58				0.0	24.0	24.0	0.0	0.0
11 /29 /99	RKS	11 : 59	1	1	0.00	0.7	23.7	23.6	0.7	0.7
11 /29 /99	RKS	12 : 0	1	2	0.30	0.8	23.6	23.6	0.8	0.8
11 /29 /99	RKS	12 : 4	4	6	0.78	1.0	23.6	23.6	1.0	0.8
11 /29 /99	RKS	12 : 37	33	39	1.59	2.4	23.3	24.1	2.4	0.6
11 /29 /99	RKS	13 : 25	48	87	1.94	4.1	23.0	24.5	4.1	0.5

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		



* Negative values denote consolidation

PERMEABILITY

TEST DATA

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		

DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	HYDRAULIC HEAD (cm)		TEMP. C°	GAUGE PRESSURE (psi)		
				INFLUENT	EFFLUENT		CELL	INFLUENT	EFFLUENT
11 /29 /99	RKS	13 : 39		0.0	24.0	19.9	65.0	55.0	55.0
11 /29 /99	RKS	15 : 47	RESET	0.0	24.0	19.5	65.0	55.0	55.0
11 /29 /99	RKS	16 : 36	RESET	0.0	24.0	19.5	65.0	56.0	54.0
11 /30 /99	RKS	7 : 26	RESET	0.0	24.0	19.5	65.0	56.0	54.0
11 /30 /99	RKS	7 : 51	RESET	0.0	24.0	19.5	65.0	57.0	53.0
11 /30 /99	RKS	9 : 31	RESET	0.0	24.0	19.5	65.0	58.0	52.0
11 /30 /99	RKS	12 : 55	RESET	0.0	24.0	19.5	65.0	59.0	51.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9743_PM
SAMPLE No.:	3202-003 (28 DAY)	EQUIPMENT No.:	1
TEST DATE:	29 November 1999		

ELAPSED TIME (minutes)	*HYDRAULIC HEAD DIFFERENCE (cm)*		*EFFLUENT - INFLUENT RATIO*	*HYDRAULIC GRADIENT (cm/cm)*	*HYDRAULIC CONDUCTIVITY (cm/sec)*	
	INFLUENT	*EFFLUENT*			*@ Temp.*	*@ 20° C*
RESET				3.457		
RESET	0.0	0.0		3.457		
RESET	0.0	0.0		23.720		
RESET	0.0	0.0		23.720		
RESET	0.0	0.0		43.983		
RESET	0.0	0.0		64.246		
RESET	0.0	0.0		84.509		

PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	125.5 pcf	131.5 pcf
DRY UNIT WEIGHT	110.2 pcf	110.1 pcf
MOISTURE CONTENT	13.9 %	19.4 %
PERMEABILITY @ 20°C	1.5E-08 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	004	004
2. WT MOISTURE TIN (tare weight)	0.00 g	192.17 g
3. WT WET SOIL + TARE	643.20 g	866.80 g
4. WT DRY SOIL + TARE	564.83 g	757.00 g
5. WT WATER, Ww	78.37 g	109.80 g
6. WT DRY SOIL, Ws	564.83 g	564.83 g
7. MOISTURE CONTENT, W	13.87 %	19.44 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.96 in.*	*2.97 in.*	*2.78 in.*	*2.87 in.*
No. 2	*2.96 in.*	*2.97 in.*	*2.81 in.*	*2.80 in.*
No. 3	*2.97 in.*	*2.97 in.*	*2.90 in.*	*2.79 in.*
Average	2.96 in.	2.97 in.	2.83 in.	2.82 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*643.20 g*	*674.63 g*
Area, Ao	6.90 in^2	6.93 in^2
Volume, Vo	19.52 in^3	19.54 in^3
Bulk Unit Weight	125.5 pcf	131.5 pcf
Dry Unit Weight	110.2 pcf	110.1 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
11/29/99	13 : 31	MC	7.0	5.0	5.3				
11/29/99	13 : 58	MC	17.0	15.0	15.3	6.9	10.0	1.6	0.16
11/29/99	14 : 35	MC	27.0	25.0	25.2	20.4	10.0	5.1	0.51
11/29/99	15 : 10	MC	37.0	35.0	35.2	32.3	10.0	7.1	0.71
11/29/99	15 : 47	MC	47.0	45.0	45.3	43.5	10.0	8.3	0.83
11/29/99	16 : 29	MC	57.0	55.0	55.5	54.1	10.0	8.8	0.88
11/29/99	17 : 31	MC	67.0	65.0	65.5	64.6	10.0	9.1	0.91
11/30/99	7 : 8	RKS	77.0	75.0	*	75.1	10.0	9.6	0.96
11/30/99	7 : 8	RKS	67.0	65.0	*	*	*	*	*

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		

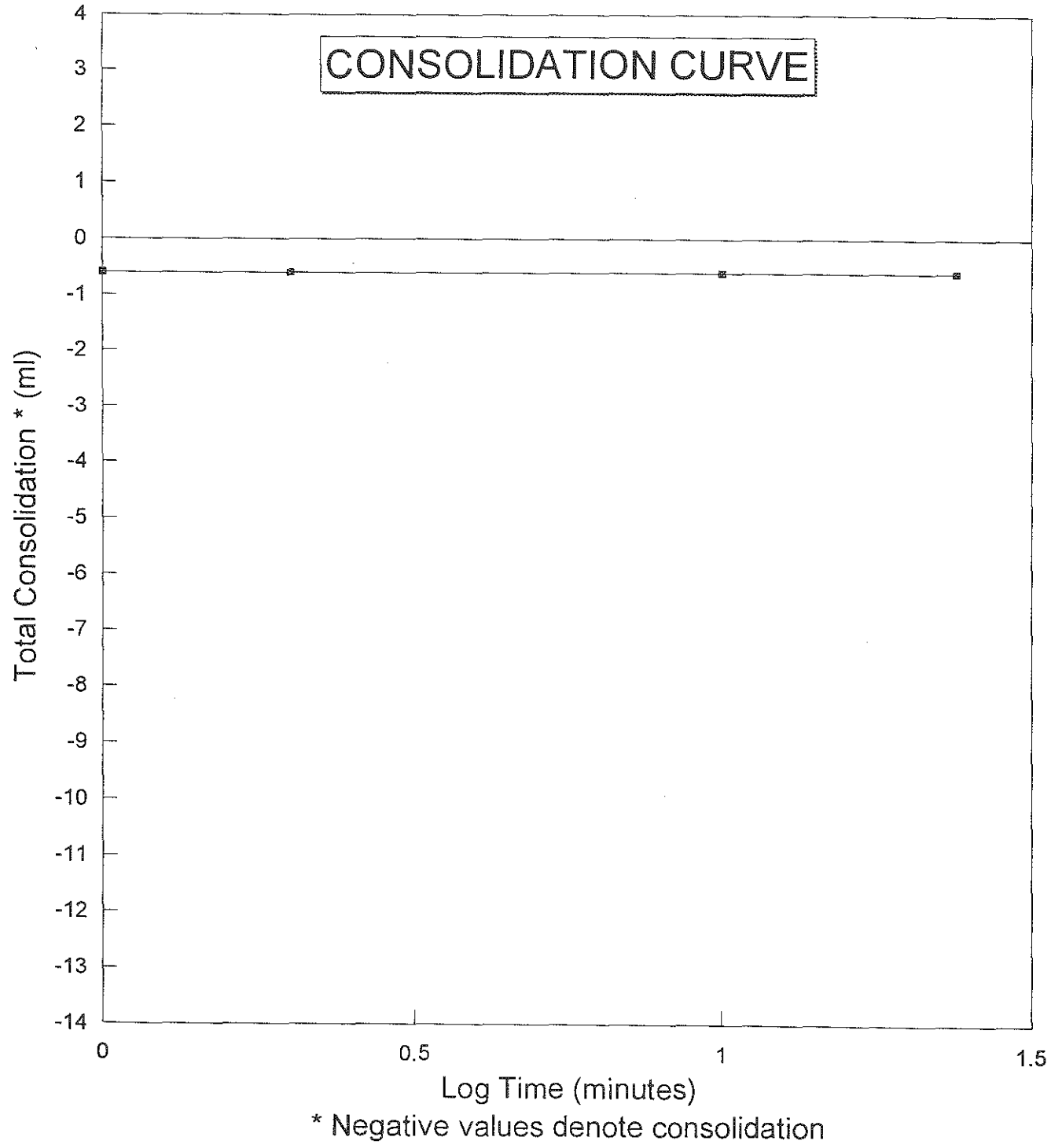
CELL PRESSURE: 75 psi BACK PRESSURE: 65 psi EFFECTIVE STRESS: 10 psi

TEST DATE	TESTED BY	TIME (Military)	ELAPSED TIME (minutes)	TOTAL TIME (minutes)	TOTAL TIME (Log)	SPECIMEN CONSOLIDATION (ml)				
						READING			ACTUAL	
						CELL	BOTTOM	TOP	CELL (Cc)	TOTAL (Ct)
11 /30 /99	RKS	7 : 16				0.0	25.0	25.0	0.0	0.0
11 /30 /99	RKS	7 : 17	1	1	0.00	0.5	24.7	24.7	0.5	0.6
11 /30 /99	RKS	7 : 18	1	2	0.30	0.5	24.7	24.7	0.5	0.6
11 /30 /99	RKS	7 : 26	8	10	1.00	0.6	24.7	24.7	0.6	0.6
11 /30 /99	RKS	7 : 40	14	24	1.38	0.6	24.7	24.7	0.6	0.6

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		



* Negative values denote consolidation

PERMEABILITY

TEST DATA

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		

DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	HYDRAULIC HEAD (cm)		TEMP.	GAUGE PRESSURE (psi)		
				INFLUENT	EFFLUENT	C°	CELL	INFLUENT	EFFLUENT
11 /30 /99	RKS	7 : 48		0.0	25.0	16.5	75.0	65.0	65.0
11 /30 /99	RKS	8 : 15	RESET	0.0	25.0	16.5	75.0	66.0	64.0
11 /30 /99	CG	9 : 8	RESET	0.0	25.0	16.5	75.0	67.0	63.0
11 /30 /99	CG	10 : 42	94	0.2	24.8	16.5	75.0	67.0	63.0
11 /30 /99	RKS	11 : 42	60	0.3	24.7	17.5	75.0	67.0	63.0
11 /30 /99	RKS	12 : 57	RESET	0.0	25.0	17.5	75.0	68.0	62.0
11 /30 /99	RKS	16 : 10	193	0.4	24.6	17.0	75.0	68.0	62.0
12 / 1 /99	RKS	7 : 17	907	1.7	22.9	16.0	75.0	68.0	62.0
12 / 1 /99	RKS	10 : 38	201	2.0	22.6	16.5	75.0	68.0	62.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9666_PM
SAMPLE No.:	3202-004 (28 DAY)	EQUIPMENT No.:	4
TEST DATE:	29 November 1999		

ELAPSED TIME (minutes)	HYDRAULIC HEAD DIFFERENCE (cm)		EFFLUENT - INFLUENT RATIO	HYDRAULIC GRADIENT (cm/cm)	HYDRAULIC CONDUCTIVITY (cm/sec)	
	INFLUENT	EFFLUENT			@ Temp.	@ 20° C
RESET				3.478		
RESET				23.049		
RESET				42.620		
94	0.2	0.2	1.00	42.564	1.87E-08	2.03E-08
60	0.1	0.1	1.00	42.536	1.47E-08	1.56E-08
RESET				62.191		
193	0.4	0.4	1.00	62.080	1.25E-08	1.34E-08
907	1.3	1.7	1.31	61.662	1.00E-08	1.10E-08
201	0.3	0.3	1.00	61.579	9.07E-09	9.85E-09

PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		

Due to the impermeability of the sample no readings were recorded during testing.

No movement was observed even with an increase in the hydraulic gradient.

Kiber approximates the hydraulic conductivity of the sample to be less than 1.0E-9.

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	120.8 pcf	132.4 pcf
DRY UNIT WEIGHT	105.3 pcf	111.6 pcf
MOISTURE CONTENT	14.7 %	18.6 %
PERMEABILITY @ 20°C	< 1.0E-9 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	005	005
2. WT MOISTURE TIN (tare weight)	0.00 g	194.60 g
3. WT WET SOIL + TARE	628.10 g	844.10 g
4. WT DRY SOIL + TARE	547.60 g	742.20 g
5. WT WATER, Ww	80.50 g	101.90 g
6. WT DRY SOIL, Ws	547.60 g	547.60 g
7. MOISTURE CONTENT, W	14.70 %	18.61 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.97 in.*	*2.96 in.*	*2.97 in.*	*2.74 in.*
No. 2	*2.97 in.*	*2.96 in.*	*2.85 in.*	*2.66 in.*
No. 3	*2.97 in.*	*2.97 in.*	*2.76 in.*	*2.73 in.*
Average	2.97 in.	2.96 in.	2.86 in.	2.71 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*628.10 g*	*649.50 g*
Area, Ao	6.93 in^2	6.90 in^2
Volume, Vo	19.81 in^3	18.69 in^3
Bulk Unit Weight	120.8 pcf	132.4 pcf
Dry Unit Weight	105.3 pcf	111.6 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
11/30/99	11 : 4	RKS	7.0	5.0	5.3				
11/30/99	11 : 41	RKS	17.0	15.0	15.2	8.9	10.0	3.6	0.36
11/30/99	12 : 51	RKS	27.0	25.0	25.3	21.1	10.0	5.9	0.59
11/30/99	13 : 38	RKS	37.0	35.0	35.2	32.2	10.0	6.9	0.69
11/30/99	14 : 10	RKS	47.0	45.0	45.3	43.3	10.0	8.1	0.81
11/30/99	14 : 47	RKS	57.0	55.0	55.3	54.0	10.0	8.7	0.87
11/30/99	15 : 9	MC	67.0	65.0	65.4	64.3	10.0	9.0	0.90
11/30/99	16 : 7	MC	77.0	75.0	75.3	74.8	10.0	9.4	0.94
11/30/99	16 : 51	MC	87.0	85.0	*	84.9	10.0	9.6	0.96
11/30/99	16 : 52	MC	77.0	75.0	*	*	*	*	*

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		

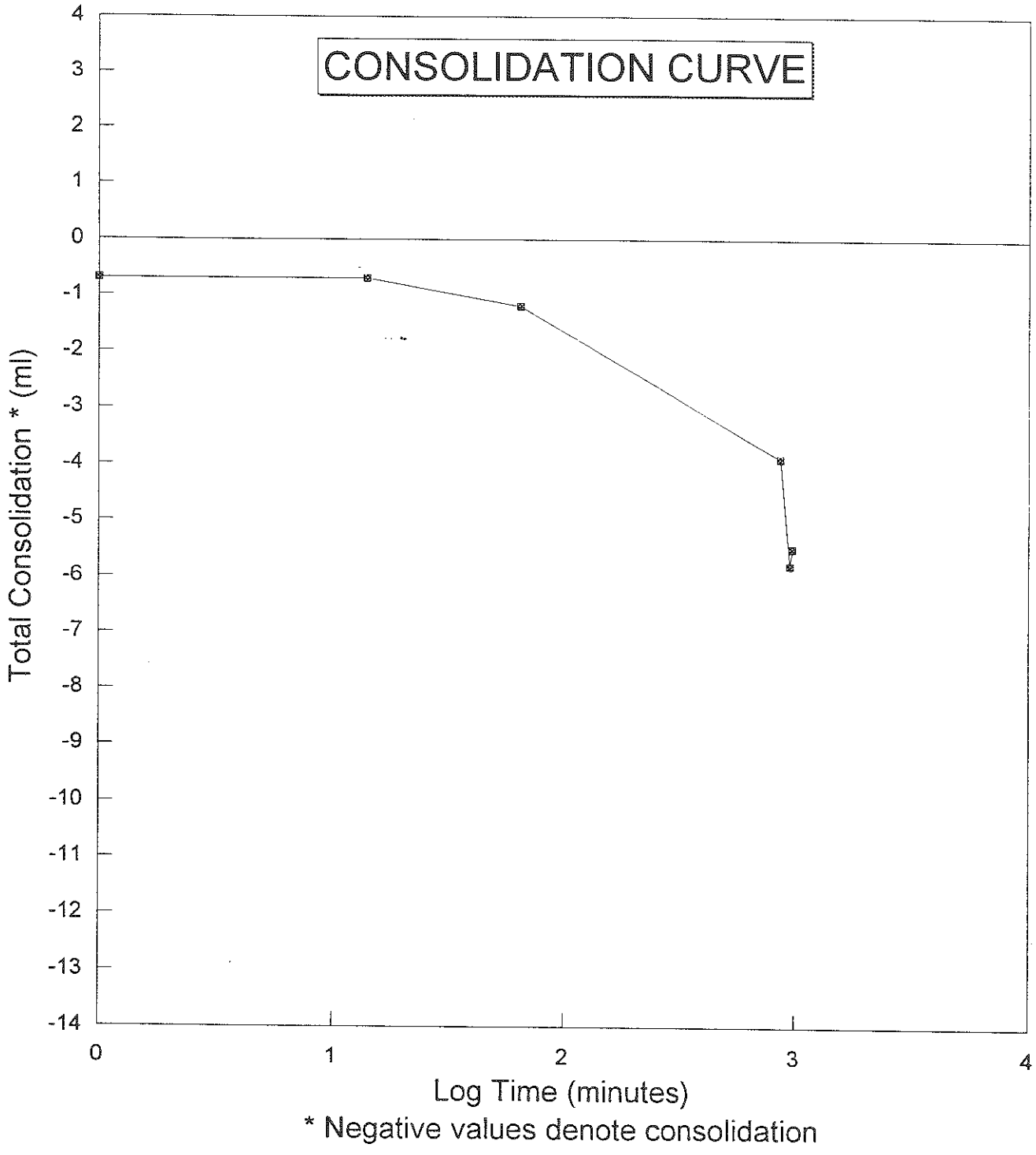
CELL PRESSURE: 85 psi BACK PRESSURE: 75 psi EFFECTIVE STRESS: 10 psi

TEST DATE	TESTED BY	TIME (Military)	ELAPSED TIME (minutes)	TOTAL TIME (minutes)	TOTAL TIME (Log)	SPECIMEN CONSOLIDATION (ml)				
						READING			ACTUAL	
						CELL	BOTTOM	TOP	CELL (Cc)	TOTAL (Ct)
11 /30 /99	RKS	16 : 54				0.0	24.0	24.0	0.0	0.0
11 /30 /99	RKS	16 : 55	1	1	0.00	0.6	23.7	23.6	0.6	0.7
11 /30 /99	RKS	17 : 8	13	14	1.15	0.8	23.7	23.6	0.8	0.7
11 /30 /99	RKS	17 : 59	51	65	1.81	0.9	23.8	23.0	0.9	1.2
12 / 1 /99	RKS	7 : 16	797	862	2.94	1.6	23.1	21.0	1.6	3.9
12 / 1 /99	RKS	8 : 41	85	947	2.98	1.6	23.2	19.0	1.6	5.8
12 / 1 /99	RKS	9 : 5	24	971	2.99	1.8	23.3	19.2	1.8	5.5

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		



* Negative values denote consolidation

PERMEABILITY

TEST DATA

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		

DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	HYDRAULIC HEAD (cm)		TEMP. C°	GAUGE PRESSURE (psi)		
				INFLUENT	EFFLUENT		CELL	INFLUENT	EFFLUENT
12 / 1 /99	RKS	10 : 39		0.0	24.0	16.5	85.0	77.0	73.0
12 / 1 /99	RKS	14 : 17	RESET	0.0	24.0	17.0	85.0	78.0	72.0
12 / 2 /99	RKS	7 : 27	RESET	0.0	24.0	16.0	85.0	79.0	71.0
12 / 2 /99	RKS	16 : 5	518	0.0	24.0	17.0	85.0	79.0	71.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9742_PM
SAMPLE No.:	3202-005 (28 DAY)	EQUIPMENT No.:	3
TEST DATE:	30 November 1999		

ELAPSED TIME	*HYDRAULIC HEAD DIFFERENCE (cm)*		*EFFLUENT - INFLUENT*	*HYDRAULIC GRADIENT*	*HYDRAULIC CONDUCTIVITY (cm/sec)*	
(minutes)	*INFLUENT*	*EFFLUENT*	*RATIO*	*(cm/cm)*	*@ Temp.*	*@ 20° C*
RESET				42.035		
RESET	0.0	0.0		61.401		
RESET	0.0	0.0		80.766		
518	0.0	0.0		80.766	0.00E+00	0.00E+00

PERMEABILITY

SUMMARY OF RESULTS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		

TESTING PARAMETER	INITIAL	FINAL
BULK UNIT WEIGHT	118.8 pcf	128.5 pcf
DRY UNIT WEIGHT	105.5 pcf	106.7 pcf
MOISTURE CONTENT	12.6 %	20.5 %
PERMEABILITY @ 20°C	1.0E-07 cm/sec	

PERMEABILITY

SPECIMEN CONDITIONS

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		

MOISTURE CONTENT (Dry Basis)	*INITIAL*	*FINAL*
1. MOISTURE TIN NO.	006	006
2. WT MOISTURE TIN (tare weight)	0.00 g	203.23 g
3. WT WET SOIL + TARE	682.20 g	932.80 g
4. WT DRY SOIL + TARE	605.67 g	808.90 g
5. WT WATER, Ww	76.53 g	123.90 g
6. WT DRY SOIL, Ws	605.67 g	605.67 g
7. MOISTURE CONTENT, W	12.64 %	20.46 %

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	*DIAMETER*		*HEIGHT*	
ANALYSES	*INITIAL*	*FINAL*	*INITIAL*	*FINAL*
No. 1	*2.97 in.*	*2.95 in.*	*3.20 in.*	*3.13 in.*
No. 2	*2.97 in.*	*2.95 in.*	*3.15 in.*	*3.17 in.*
No. 3	*2.97 in.*	*2.96 in.*	*3.12 in.*	*3.17 in.*
Average	2.97 in.	2.95 in.	3.16 in.	3.16 in.

SPECIMEN CONDITIONS	*INITIAL*	*FINAL*
Specimen WT, Wo	*682.20 g*	*729.57 g*
Area, Ao	6.93 in^2	6.85 in^2
Volume, Vo	21.87 in^3	21.62 in^3
Bulk Unit Weight	118.8 pcf	128.5 pcf
Dry Unit Weight	105.5 pcf	106.7 pcf

PERMEABILITY

BACK-PRESSURE SATURATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		

TEST	TIME	TESTED	TEST PRESSURES (psi)						
			APPLIED		PORE		PRESSURE CHANGE		
DATE	(military)	BY	CELL	BACK	SAT.	TEST	CELL	PORE	B-Value
11/30/99	11 : 20	MC	7.0	5.0	5.5				
11/30/99	12 : 50	MC	17.0	15.0	15.6	9.5	10.0	4.0	0.40
11/30/99	13 : 37	RKS	27.0	25.0	25.5	21.2	10.0	5.6	0.56
11/30/99	14 : 8	MC	37.0	35.0	35.4	32.9	10.0	7.4	0.74
11/30/99	14 : 46	MC	47.0	45.0	45.5	43.7	10.0	8.3	0.83
11/30/99	15 : 9	MC	57.0	55.0	55.8	54.0	10.0	8.5	0.85
11/30/99	16 : 5	MC	67.0	65.0	65.8	62.9	10.0	7.1	0.71
11/30/99	16 : 50	MC	77.0	75.0	75.7	74.9	10.0	9.1	0.91
11/30/99	17 : 58	RKS	87.0	85.0	*	85.0	10.0	9.3	0.93
11/30/99	17 : 58	RKS	77.0	75.0	75.8	*	*	*	*
12/01/99	7 : 10	RKS	87.0	85.0	*	85.4	10.0	9.6	0.96
12/01/99	7 : 10	RKS	77.0	75.0	*	*	*	*	*

* Saturation check - no data available.

PERMEABILITY

SPECIMEN CONSOLIDATION

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		

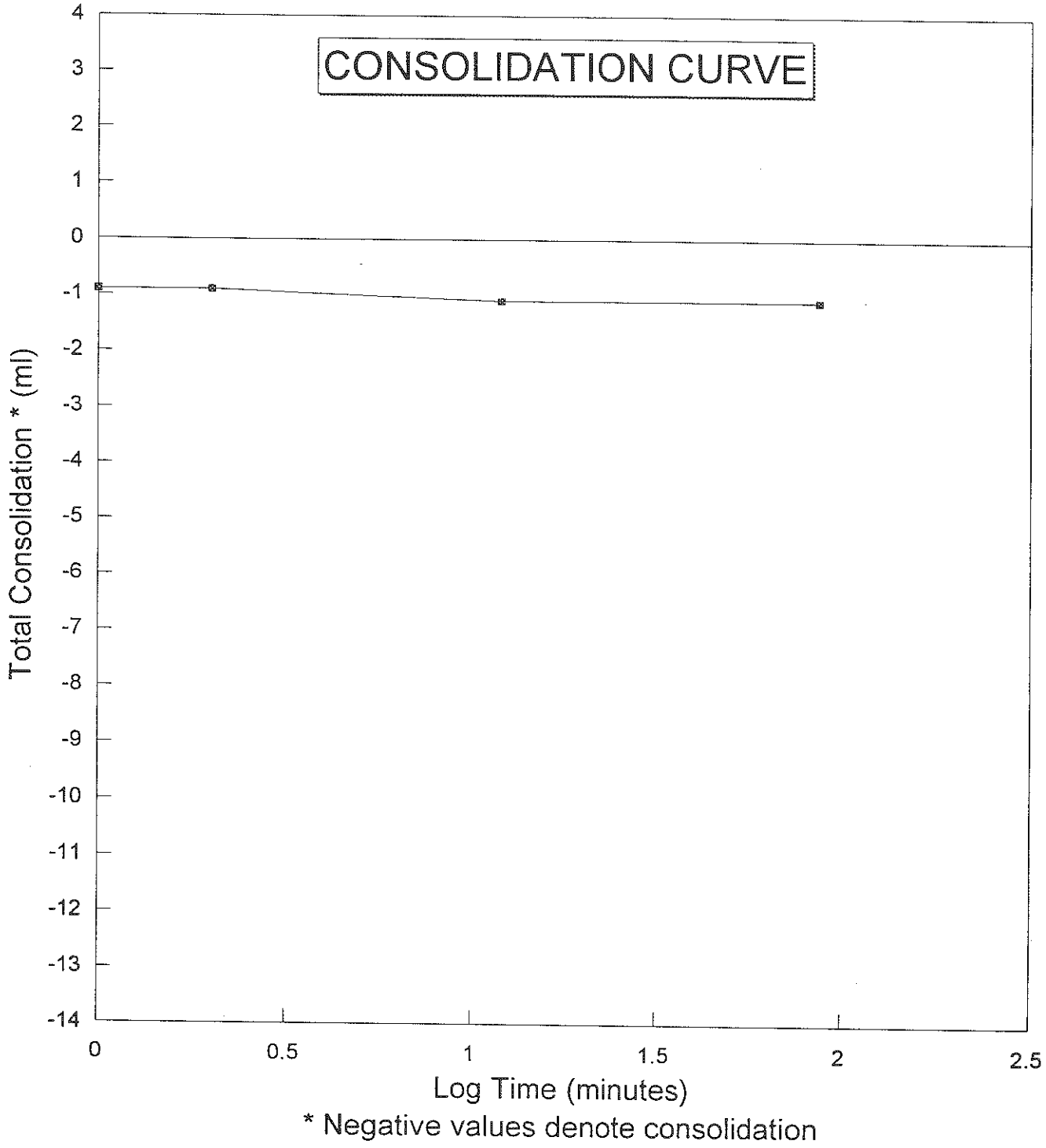
CELL PRESSURE: 85 psi BACK PRESSURE: 75 psi EFFECTIVE STRESS: 10 psi

TEST DATE	TESTED BY	TIME (Military)	ELAPSED TIME (minutes)	TOTAL TIME (minutes)	TOTAL TIME (Log)	SPECIMEN CONSOLIDATION (ml) READING CELL	READING BOTTOM	READING TOP	ACTUAL CELL (Cc)	ACTUAL TOTAL (Ct)
12 / 1 /99	RKS	7 : 15				1.0	23.0	23.0	0.0	0.0
12 / 1 /99	RKS	7 : 16	1	1	0.00	1.7	22.6	22.5	0.7	0.9
12 / 1 /99	RKS	7 : 17	1	2	0.30	1.7	22.6	22.5	0.7	0.9
12 / 1 /99	RKS	7 : 27	10	12	1.08	1.8	22.5	22.4	0.8	1.1
12 / 1 /99	RKS	8 : 42	75	87	1.94	2.0	22.5	22.4	1.0	1.1

PERMEABILITY

CONSOLIDATION CURVE

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		



* Negative values denote consolidation

PERMEABILITY

TEST DATA

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		

DATE	TESTED BY	TIME (military)	ELAPSED TIME (minutes)	HYDRAULIC HEAD (cm)		TEMP. C°	GAUGE PRESSURE (psi)		
				INFLUENT	EFFLUENT		CELL	INFLUENT	EFFLUENT
12 / 1 /99	MC	10 : 46		0.0	24.0	16.0	85.0	77.0	73.0
12 / 1 /99	RKS	12 : 1	75	0.7	23.1	16.0	85.0	77.0	73.0
12 / 1 /99	MC	13 : 7	66	1.3	22.4	17.0	85.0	77.0	73.0
12 / 1 /99	RKS	14 : 17	70	2.0	21.8	17.0	85.0	77.0	73.0
12 / 1 /99	MC	14 : 51	34	2.3	21.5	17.0	85.0	77.0	73.0

PERMEABILITY

TEST DATA (continued)

PROJECT:	Tech Alloy	TESTED BY:	RKS
PROJECT No.:	3202	TRACKING CODE:	9680_PM
SAMPLE No.:	3202-006 (28 DAY)	EQUIPMENT No.:	2
TEST DATE:	30 November 1999		

ELAPSED TIME (minutes)	*HYDRAULIC HEAD DIFFERENCE (cm)*		*EFFLUENT - INFLUENT RATIO*	*HYDRAULIC GRADIENT (cm/cm)*	*HYDRAULIC CONDUCTIVITY (cm/sec)*	
	INFLUENT	*EFFLUENT*			*@ Temp.*	*@ 20° C*
RESET				38.085		
75	0.7	0.9	1.29	37.885	1.05E-07	1.15E-07
66	0.6	0.7	1.27	37.729	9.34E-08	1.00E-07
70	0.8	0.6	0.80	37.561	9.55E-08	1.03E-07
34	0.3	0.3	1.00	37.486	8.77E-08	9.41E-08

APPENDIX C
DUST LEVEL CALCULATIONS

TECHALLOY COMPANY, INC.

Dust Levels

6/16/00

Action Level = (10^6 mg/kg)/ (SUM(Concentration/exposure limit)* Safety Factor)

SF = 2

Contaminant	Concentration (mg/kg)	Exposure Limit (mg/m^3)	C/EL (m^3/kg)	Sum(C/EL)	10^6/Sum*SF
Lead	8,395	0.05	167,900	320,787	1.56
Chrome	9,110	0.5	18,220		
Nickel	2,020	0.015	134,667		

Concentrations of lead onsite (mg/kg)	Average lead conc. (mg/kg)
11,200	8,395
5,590	